3.10. VEGETATION

INTRODUCTION

SCOPE OF THE ANALYSIS

The scope of the vegetation analysis for existing condition and effects of the alternatives is defined by stand information from the American and Crooked River planning area. Indicators incorporate timber volume and stand structure characteristics, including trees per acre, size, species composition, and snag and dead wood components. Direct and indirect effects are analyzed at the planning area level. Cumulative effects will include significant information from the planning area and adjacent areas in the watershed.

REGULATORY FRAMEWORK

The Nez Perce National Forest Plan (1987, p. II-1-II-8) established goals and objectives for the management of the Forest. Specific Forest Plan goals that apply to vegetation management in the American and Crooked River analysis area are to:

- Provide a sustained yield of resource outputs that would help support the economic structure of local communities and provide for regional and national needs (p II-1).
- Recognize and promote the intrinsic ecological and economic value of wildlife and wildlife habitats. Provide high quality and quantity of wildlife habitat to ensure diversified recreational use and public satisfaction (p. II-1).
- Protect resource values through cost-effective fire and fuels management, emphasizing fuel treatment through the utilization of material and using prescribed fire (p. II-2).
- Protect resource values through the practice of integrated pest management (p. II-2).

The Nez Perce National Forest Plan (NPFP) identified management areas to distinguish differing management emphases between geographic areas. The NPFP gives general guidelines, goals, and standards for manipulation of forest vegetation within these management areas that can be found throughout Chapter III of the Plan. Additional information on management area validation and distribution across the analysis area can be found in Appendix D of this document.

Amendment 20 to the Forest Plan incorporates Pacfish standards and guidelines into the Forest Plan. Briefly, these prohibit timber harvest in Riparian Habitat Conservation Areas (RHCA) except for salvage after a catastrophic event or to acquire desired vegetation characteristics where needed to attain Riparian Management Objectives.

The National Forest Management Act of 1976 states that "timber would be harvested from National Forest Land only where there is assurance that such lands can be adequately restocked within five years after harvest." (16 U.S.C. 1604). Additional clarification on this subject is found in the Code of Federal Regulations which specify that, "When trees are cut to achieve timber production objectives, the cuttings shall be made in a way as to assure that the technology and knowledge exists to adequately restock the lands within five years after final harvest. Research and experience shall be the basis for determining whether the harvest and regeneration practices planned can be expected to result in adequate restocking." The statement, "Five years after final harvest…" means five years after clearcutting, five years after final overstory removal in shelterwood cutting, five years after seed tree removal cut in seed tree cutting or five years after selection cutting" (36 CFR 219.27 (c) (3)).

ANALYSIS METHODS

The data sources for analysis of the existing vegetation condition were stand exam information from the Field Sampled Vegetation Database (FSVEG), activities from the Forest database (TSMRS), aerial photo interpretation, and field surveys. Additional analysis was done using the Forest Vegetation Simulator (FVS) and Geographic Information System (GIS) coverages. Data for Cover Types, and structure (size class, densities and canopy layers) were analyzed where treatments will occur. Projections and mathematical formulas were used to determine the changes for each alternative.

Initial selection of potential harvest areas was based on insect and disease severity mapping, aerial photograph interpretation, and field review. Forest stand data from Forest Service databases, including acres, slope, trees per acre (weighted average), volume per acre, acres of harvest by harvest type, habitat type, and forest type was used to determine the characteristics of vegetation in the analysis area. RHCA widths were identified based on stream characteristics and fish populations. Areas within RHCAs, designated roadless areas, high landslide prone acres, and designated old growth were identified and eliminated from further consideration. Harvest systems were assigned to the potential harvest areas based on topography, slope and access. Percent harvest removal was based on a desired future target stand and utilized stand exam data, projections from FVS, aerial photograph interpretation, and field review.

Recent scientific studies and reports, including those from the Science Integration Team of ICBEMP, point to a loss of landscape integrity as indicated by potential tree mortality from insects and disease at nearly twice the historical levels. The shift to more insect and disease vulnerable forests can be attributed to fire exclusion and past harvest practices (Hahn and others, in press; Hessburg and others, 1996).

The Interior Columbia Basin Scientific Assessment (Quigley, et al. 1997) found forest integrity to be low in the South Fork Clearwater River subbasin based on the reduction of seral tree species, changes in tree size classes and disruption to fire regimes, among other factors. The Interior Columbia Basin Scientific Assessment categorized the American and Crooked River project area as Forest Cluster 3. It states that Forest Cluster 3 has low forest integrity with high mean departures in fire frequency and severity (Quigley et al. 1996, p. 96-117).

The South Fork Clearwater Landscape Assessment (SFLA) (Nez Perce National Forest, 1998) characterized the ecological and social conditions in the South Fork Clearwater River subbasin, and provided a context for future forest management decisions in the area. The assessment recommended vegetation themes for the American and Crooked River watersheds. The recommended vegetation theme is to restore vegetation pattern. More detailed descriptions of these themes are found in the SFLA 1998, p. 138-141 and 146-149.

ROADSIDE SALVAGE

The purpose of this action is to use incidental salvage to recover economic value over limited areas immediately adjacent to haul routes. The scope of this action is limited in extent to avoid large unplanned openings; and is limited in intensity to minimize loss of elk hiding cover, to prevent large areas devoid of snags or recruitable soil wood, and to avoid continuous accumulations of fine slash along roads that may be used as fuel breaks in fire suppression. Proposals to treat extensive areas of highly concentrated mortality adjacent to roadways are either described as specific treatment units in this analysis or would be addressed in subsequent environmental analyses.

Design Criteria:

- Roadside salvage would be limited to dead or dying trees, with no harvest of standing trees more than 20 inches in diameter. (Windthrown trees would not be subject to the diameter limit.)

- Salvage would be limited to areas adjacent to haul roads. No tree cutting or yarding would occur in RHCAs or in allocated existing or replacement old growth.
- All yarding would be done from the road. Areas above steep cutslopes that cannot be protected from yarding damage would be omitted from salvage. Yarding distance would not exceed 100 feet.
- No more than 80 dead or dying trees per mile (approximately 8 trees/acre) could be designated for cutting on each side of the road.
- Maximum opening size is one acre on each side of a road, or a maximum of 400 feet along the road.
- Openings would be separated from other forest openings by at least 200 feet of pole size or larger forest along the road, on both sides, to provide cover for wildlife crossing.
- Slash from salvage would be lopped and scattered, hand piled and burned in the woods, or removed from the site at the discretion of the District Ranger considering the Forest objective of maintaining less than 12 tons per acre of fine fuels.
- This component of the action would comply with all applicable design criteria developed for the action as a whole.
- These design criteria are not intended to limit or interfere with brushing, clearing, or hazard reduction activities associated with routine road maintenance.

3.10.1. VEGETATION – AMERICAN RIVER

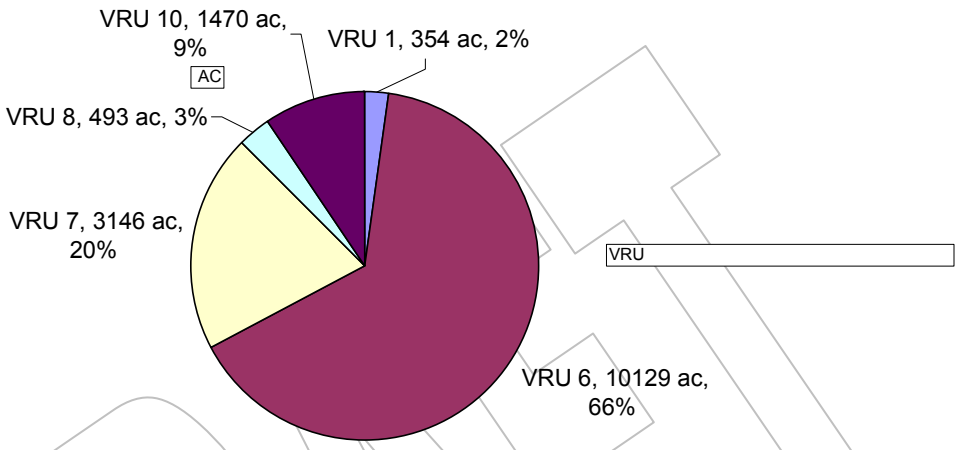
INTRODUCTION

Plant communities in the analysis area can be seen as a mosaic of patches that change in composition, size, and juxtaposition over time. Wildlife and humans respond in varying ways to a particular pattern of vegetation. In fact, processes such as fire, plant community succession, insect and disease activity, drought, and grazing all have the ability to change the pattern that exists at any given time. Additionally, features such as climate, soil, slope, aspect, and elevation control the bounds within which patterns can change. The terms Vegetation Response Unit (VRUs) and Potential Vegetation Groups (HVGs), which occur within VRUs, are used to describe these bounds. The VRU is intended to be an aggregation of land having similar capabilities and potentials for management. As mapped polygons these units have similar patterns in potential natural communities (habitat types), soils, hydrologic function, landform and topography, lithology, climate, air quality, and natural disturbance processes (fire regimes, succession, productivity, nutrient cycling). The interaction of all these processes creates a mosaic across the area landscape. Within individual polygons of any VRU over time, the proportion of age and size classes, successional stage, impacts of fire and/or disease will be dynamic as natural and managed disturbances occur. Potential Vegetation Groups are a grouping of vegetative types based on similar general moisture or temperature environments.

The VRUs for the American River portion of the analysis are shown in figure 3.6. Within these delineations, presettlement processes (e.g., climate, fire, insect and disease activity) likely operated within somewhat predictable ranges. Understanding how these past disturbance regimes worked and the pattern of vegetation change, are fundamental to current management of ecosystems. Furthermore, this knowledge can be used to help design management structures that sustain patterns of vegetation at the scale, frequency, and kind of change to which native species are adapted.

Figure 3.6

AMERICAN RIVER VRU'S



(*VRU 1*: Convex slopes, subalpine fir, *VRU 6*: Cold basins, grand fir and subalpine fir,

VRU 7: Moist uplands, grand fir and Pacific yew, *VRU 8*: Breaklands, cedar and grand fir, *VRU 10*: Uplands, alder, grand fir and subalpine fir habitat types.)

3.10.1.1. INDICATOR 1 - COMPOSITION (COVER TYPE/SPECIES/LAYER/AGE)

EXISTING CONDITION

The historic and existing condition of vegetation in the American and Crooked Rivers Project Area is discussed in general terms in Chapter 3, pg 20, Chapter 3 pgs 82-98, Chapter 4 pages138 -141 (American River) and Chapter 4 pgs 146-149 (Crooked River) of the SFLA.

For the past decade, mature lodgepole pine mortality from a mountain pine beetle epidemic has been occurring in the Upper reaches of the South Fork Clearwater River. The epicenters have been concentrated in the Red River drainages and are spiraling out to adjacent drainages, including the American river on the North and the Crooked River to the west. This is the most extensive and damaging outbreak in the Region. The highest concentrations of beetle-caused mortality were noted around Red River and Elk City. Through the analysis of field surveys and stand analyses it has been determined that lodgepole pine overstory mortality is currently estimated at 70 to 80 percent in these areas. A slight decrease in lodgepole pine mortality in the Red River watershed was noted between 2002 and 2003 due to host depletion (Gibson, 2003). In the summer of 2003, mortality within the American and Crooked River project area was somewhat

lower at 50 to 60 percent. However, lodgepole mortality will likely advance to the same level as in the Red River drainage during the upcoming growing season.

Indicators of the existing condition of vegetation and effects of various management alternatives to the vegetation are described by forest cover types and structure (including size classes, canopy layers, and stand density).

The American River portion of the project area encompasses approximately 15,600 acres. The Forest Service Timber Stand Management Record System (**TSMRS**) indicates that previous harvest in the project area, dating from the 1950s to the present occurred on approximately 2,473 acres. Harvest methods included 516 acres of thinning/salvage, 743 acres of shelterwood/seed tree, and 1214 acres of clearcut. Figure 3.7 portrays harvest by method, acres, and percentage of the analysis area.

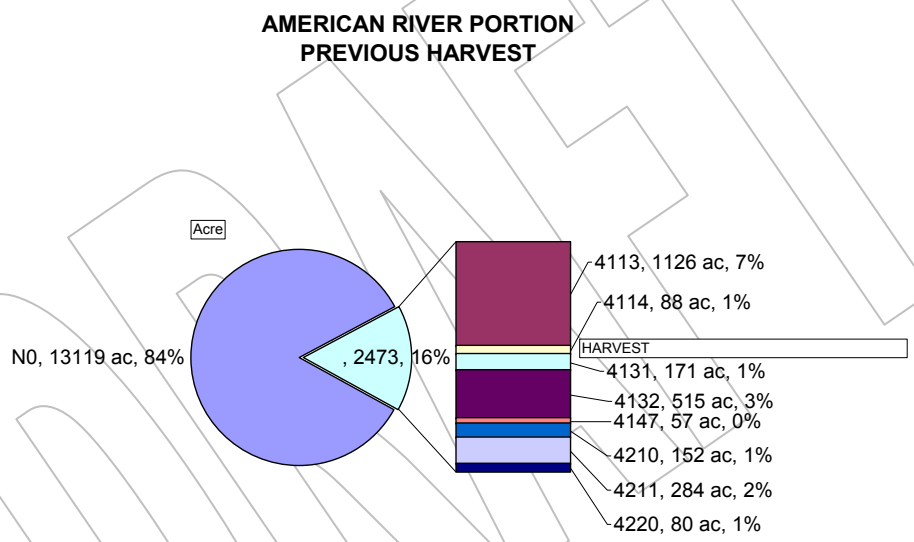


Figure 3.7

(Harvest codes: N0 – no harvest, 4113 – stand clearcut, 4114 – clearcut with reserve trees, 4131 - shelterwood seed cut, 4132 – seed tree cut, 4147 – seed tree final cut, 4210 – improvement cut, 4211 – liberation cut, 4220 – thinning)

FOREST COVER TYPES

A combination of wildfire, intentional fire, timber harvest, and fire suppression have shaped the existing pattern and composition of vegetation in the analysis area. The greatest changes from historic vegetation conditions include:

Declines in lodgepole pine-dominated communities due to harvest, fire suppression and forest succession.

Increases in more shade tolerant tree species, such as subalpine fir and grand fir, due to fire suppression and forest succession.

Declines in shrubland, riparian shrub, and riparian meadow due to forest encroachment, agricultural conversion, and forest succession

Whitebark pine has declined seriously from blister rust, fire exclusion and mountain pine beetle. Western white pine, never abundant, has also declined from blister rust.

Early seral structural stages, including forest openings, seedling and sapling, and pole stands, with snags and down wood, have decreased because of fire suppression. Medium and large tree classes have increased in most areas except larch and ponderosa pine forests.

Figure 3.8 and Table 3.87 display cover types in the American River portion of the analysis area.

Figure 3.8

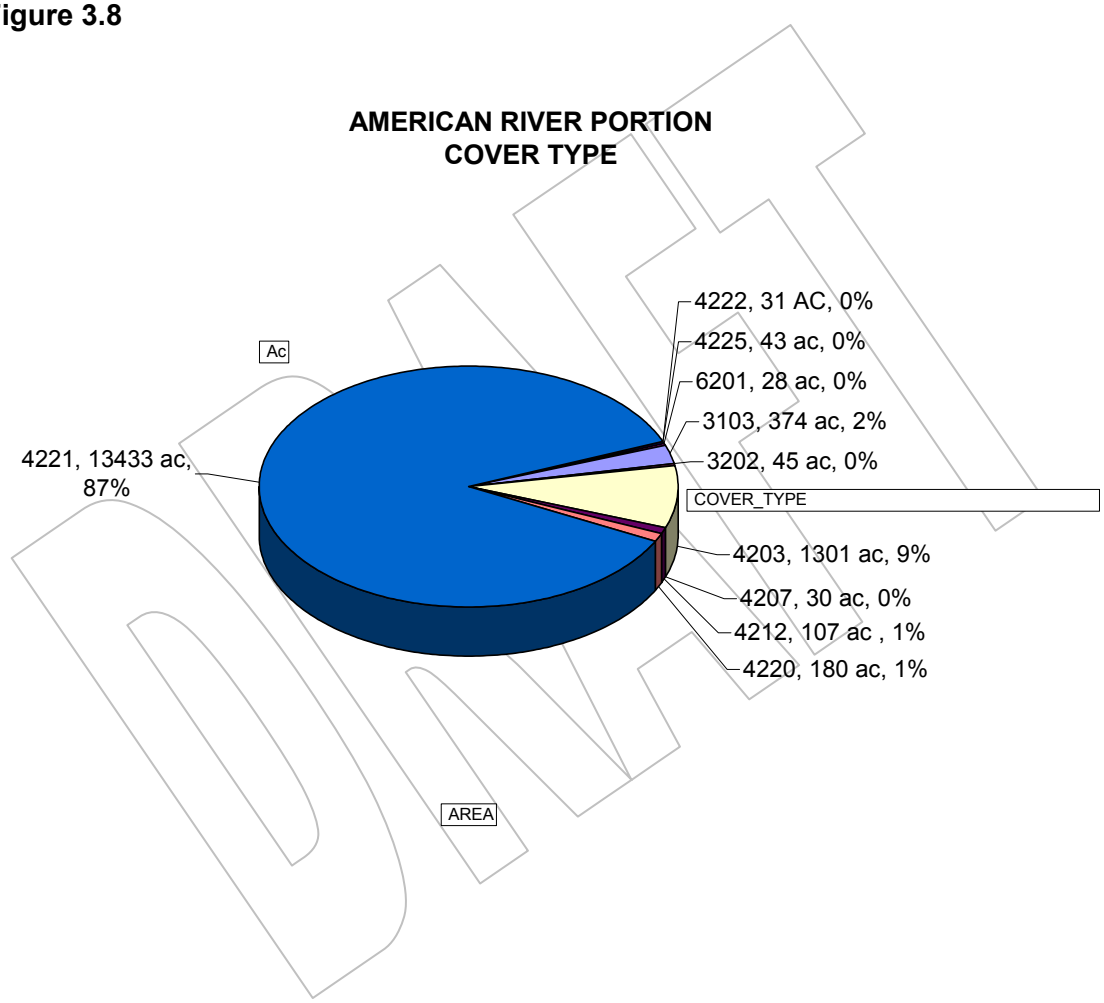


Table 3.87: American River Portion Cover Types.

CODE	COVER TYPE
3103	Herbaceous/low shrub clearcut
3202	Mesic shrub: huckleberry, etc.,
4203	Lodgepole pine
4207	Grand fir
4212	Douglas-fir
4215	Larch
4219	Whitebark pine
4220	Subalpine fir/Engelmann spruce/lodgepole
4221	Mixed conifer (usually grand fir, Douglas-fir and lesser larch and lodge
4222	Xeric conifer (ponderosa pine and Douglas fir)
4223	Douglas-fir/lodgepole pine
4224	Burned timber
4225	Larch and grand fir
5201	Water
6101	Riparian conifer (wet spruce fir) usually
6201	Wet meadow

STRUCTURE (SIZE CLASSES, DENSITY AND CANOPY LAYERS)

SIZE CLASSES

Average tree size varies depending on year of origin, tree species, and growing conditions. Approximately five percent of the analysis area consists of regenerating harvest units with tree diameters less than five inches and 92 percent of the area supports trees with five inches diameter at breast height (DBH) or greater. Less than one percent of the area has trees with diameters predominantly 21-inches or greater. Small trees (9-14 inch diameter breast height [dbh]) are probably more abundant than typical of a natural landscape. Figure 3.9 displays existing tree size classes in the project area.

Figure 3.9

AMERICAN RIVER PORTION
SIZE CLASS DISTRIBUTION

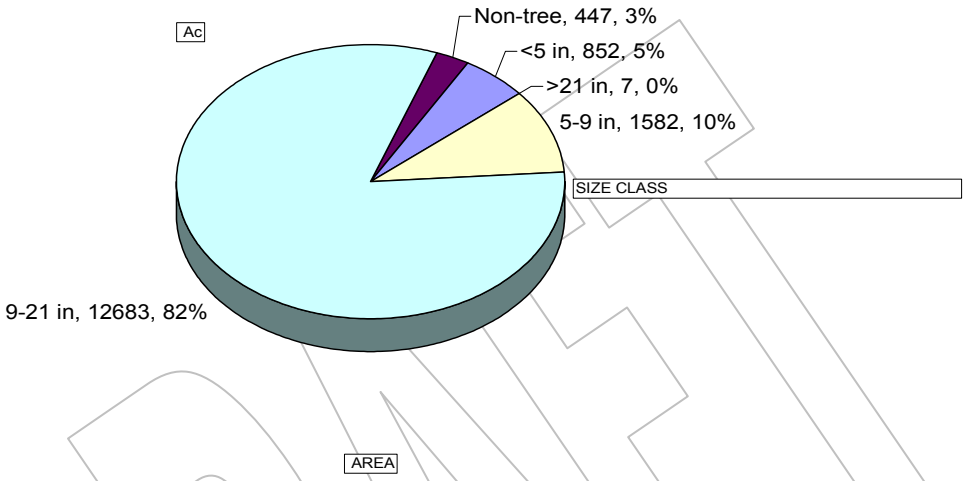
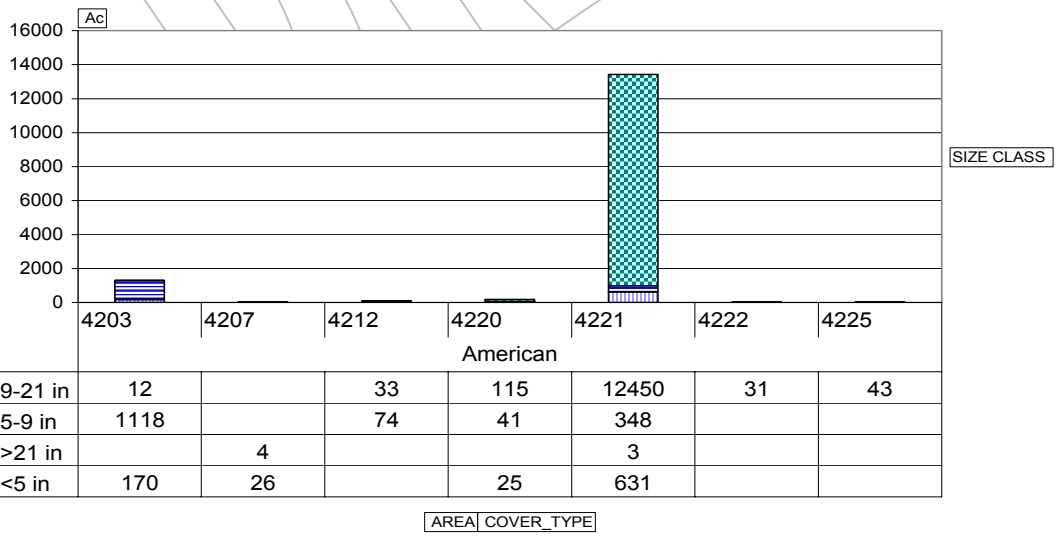


Figure 3.10 displays the current cover type and size class data for the forested area in the American River portion.

Figure 3.10

AMERICAN RIVER PORTION
COVER TYPE/SIZE CLASS



	4203	4207	4212	4220	4221	4222	4225
9-21 in	12		33	115	12450	31	43
5-9 in	1118		74	41	348		
>21 in		4			3		
<5 in	170	26		25	631		

STAND DENSITY

Stand density, measured in trees per acre vary widely across the project area. Variations are due to elevation, aspect, soils and moisture, as well as disturbances such as insect activity, fire and

harvest. Stand densities in previously harvested, regenerated stands in the project area range from approximately 1,000 to 4,000 trees per acre of sapling to pole-sized trees in unthinned stands, to approximately 435 trees per acre in thinned stands. Stand densities in the table below have been calculated for previously unmanaged stands in the project area. One consequence of increased stand densities is the increase in fuel loading (tons per acre of vegetative fuel) that could increase fire intensity, severity and resistance to control. Table 3.88 displays average stand densities by size class for previously unmanaged stands in the project area.

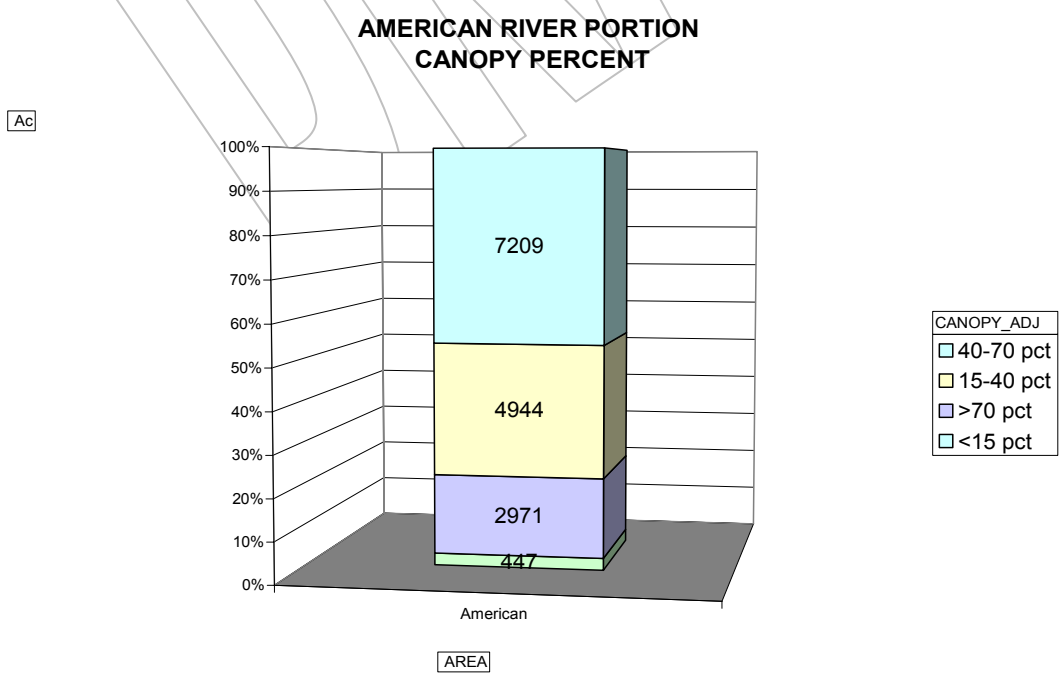
Table 3.88: Unmanaged Stand Densities in the Project Area

Size Class	Trees/Acre	Acres by Size Class	Percent of Project Area
Seedling/Sapling	1,300	852	5%
Pole (5-9 inch DBH)	66	1,582	10%
Small-Medium Trees (9-21 inch DBH)	53	12,683	82%
21 + inch DBH	5	7	<1%
Total (5" DBH and greater)	167	14,272	92%

CANOPY

What were once relatively simple one and two story stands have transitioned to more complex multi-story stands. Lodgepole pine mortality will further accelerate this shift toward multi-storied conditions. Figure 3.11 displays canopy layers in the project area.

Figure 3.11



ENVIRONMENTAL EFFECTS

Forest succession, insect and disease activity, timber harvest, fire and fire suppression have resulted in changed cover types and forest structure since presettlement (USDA, 2003). Changes in forest cover types and structure (size class, stand density and canopy layers) are used as indicators to quantify effects on vegetation. Cumulative effects are analyzed within the American River Drainage.

All action alternatives would have some direct effects to cover types and stand structure. All action alternatives would reduce the potential for severe fire through fuel removal and modify the susceptibility of forested stands to insect or disease outbreaks. The difference between the alternatives is in type of treatment, number of acres treated, and amount of fuel removal. All action alternatives would implement prescribed fire treatments in residual stands following harvest and fuel removal. Many stands have too much existing dead material and live ladder fuel to safely use prescribed burning without prior thinning and reduction.

Prescribed harvests will reduce the canopy by approximately 90 percent in clearcuts, 80 percent in seed tree units, 70 percent in shelterwoods, and 50 -60 percent on thinned acres.

COVER TYPES

DIRECT EFFECTS – COVER TYPES

ALTERNATIVE A – NO ACTION ALTERNATIVE

There are no direct effects to cover types associated with this alternative. Cover types in the project area would continue to change without direct intervention of man. Changes through time will vary depending on the intensity of disturbances such as fire, weather events, disease, and insect epidemics.

ALTERNATIVE B

Timber harvest and fuel reduction treatments would occur on approximately 725 acres. Approximately 292 acres would be clearcut, 222 acres would be shelterwood, 29 acres would be seed tree, 43 acres would be commercially thinned, and 135 acres would be in roadside salvage. Direct effects would include the following changes in cover types in the harvest and fuel treatment areas.

Acres of herbaceous clearcut would increase by approximately 321 acres. This acreage would decrease as trees become reestablished on these acres and canopy closure excludes herbaceous ground cover. Most of these acres would move towards short-lived intolerant (lodgepole pine) and mixed conifer cover types over time. Lodgepole pine cover type would be reduced by approximately 214 acres. Mixed conifer cover types would be reduced by approximately 143 acres.

ALTERNATIVE C

Timber harvest and fuel reduction treatments would occur on approximately 875 acres. Approximately 357 acres would be clearcut, 246 acres would be shelterwood, 29 acres would be seed tree, 92 acres would be commercially thinned, and 151 acres would be in roadside salvage. Direct effects would include the following changes in cover types in the harvest fuel treatment areas.

Acres of herbaceous clearcut would increase by approximately 381 acres. This acreage would decrease as trees become reestablished on these acres and canopy closure excludes herbaceous ground cover. Most of these acres would move towards short-lived intolerant (lodgepole pine) and

mixed conifer cover types over time. Lodgepole pine cover type would be reduced by 227 acres. Mixed conifer cover types would be reduced by approximately 209 acres.

ALTERNATIVE D

Timber harvest and fuel reduction treatments would occur on approximately 1103 acres. Approximately 357 acres would be clearcut, 487 acres would be shelterwood, 29 acres would be seed tree, 99 acres would be commercially thinned, and 137 acres would be in roadside salvage. Direct effects would include the following changes in cover types in the harvest and fuel treatment areas.

Acres of herbaceous clearcut would increase by approximately 381 acres. This acreage would decrease as trees become reestablished on these acres and canopy closure excludes herbaceous ground cover. Most of these acres would move towards short-lived intolerant (lodgepole pine) and mixed conifer cover types over time. Lodgepole pine cover type would be reduced by 227 acres. Mixed conifer cover types would be reduced by approximately 209 acres.

ALTERNATIVE E

Timber harvest and fuel reduction treatments would occur on approximately 444 acres. Approximately 77 acres would be clearcut, 199 acres would be shelterwood, 19 acres would be seed tree, 21 acres would be commercially thinned, and 138 acres would be in roadside salvage. Direct effects would include the following changes in cover types in the harvest and fuel treatment areas.

Acres of herbaceous clearcut would increase by approximately 95 acres. This acreage would decrease as trees become reestablished on these acres and canopy closure excludes herbaceous ground cover. Most of these acres would move towards short-lived intolerant (lodgepole pine) and mixed conifer cover types over time. Lodgepole pine cover type would be reduced by 81 acres. Mixed conifer cover types would be reduced by approximately 52 acres.

INDIRECT EFFECTS – COVER TYPES

ALTERNATIVE A – NO ACTION ALTERNATIVE

Passive management is a conscious decision with short and long-term ecosystem consequences. Preservation of dynamic ecosystems requires precisely timed, effectively planned and implemented actions if desirable characteristics of those ecosystems are to remain intact. Processes will take place whether at the hand of man or at random under the no action alternative. Anticipated effects of processes that will occur with no human intervention can provide a benchmark against which to measure effects of active management.

Forest cover types in the project area would shift towards mixed conifer (primarily grand fir and subalpine fir) cover types. Susceptibility to insect attacks and root diseases affecting conifer species would be expected to increase. Mountain pine beetle would continue to cause extensive mortality to lodgepole and ponderosa pine in the project area until host depletion results in a decline in the beetle population to endemic levels. As grand fir, Douglas-fir and subalpine fir establish and dominate in stands previously dominated by lodgepole pine, these species would be highly susceptible to root disease and insect attack, thus contributing to increased fuel loading in these stands.

Fire suppression would continue throughout the project area, allowing fuels to build up and disrupting the natural fire disturbance pattern. Low severity ground fire would not occur in the project area at the scale necessary to maintain ponderosa pine and western larch cover types. At some point, fire would likely reestablish lodgepole pine dominance in areas where seed sources exist and mineral soil is exposed crating favorable seedbeds for conifer reestablishment.

With current conifer stocking and growth rates, and elevated levels of insects and disease, the “no action” alternative would not help attain Forest Plan goals nor meet the purpose and need of this project. This alternative would not help achieve the Forest Plan recommendation of maintaining forest stands dominated by relatively pest-resistant species to maintain a sustainable condition. Under this alternative no reduction would be made in total tree numbers or stocking levels of pest-prone tree species. Improvements such as reduction in susceptible species as well as enhanced growth and vigor of residual trees through timber harvest and prescribed burning would not be made to enhance forest health and ecosystem sustainability.

Stocking levels of live trees would continue to increase while individual tree vigor would decrease, increasing susceptibility to damaging insects and disease. Early seral, shade-intolerant trees such as ponderosa pine and western larch would decrease in numbers while the shade tolerant species Douglas fir and grand fir would increase. The shrub, forb, and grass component of forest stands would continue to decline.

Forest stands where the principle species is Douglas fir, true fir, or Englemann spruce are highly susceptible to outbreaks of defoliators such as western spruce budworm and Douglas fir tussock moth. In recent years portions of the American River have experienced damaging levels of hemlock lopper. The following factors make forest stands within the analysis area particularly susceptible to defoliator attack.

Many forest stands are multi-storied. In a tussock moth, budworm or other defoliator infestation, the larvae feed on new growth of larger trees. As the caterpillars mature, they drop off the tree for a variety of reasons (wind, exhaustion of food supply, etc.). Landing on foliage suitable for foraging (such as Douglas fir or grand fir) results in additional damage.

Older trees in many forest stands are not vigorous. Damage from defoliators, bark beetles, and other insect pests could trigger eventual mortality.

The conifers in many of the forest stands in the American River Analysis Area are stagnant. Many of these trees are particularly vulnerable to defoliator and bark beetle attack.

Root disease is apparent in portions of the planning area. During a defoliator or bark beetle attack mortality is often first noticed in root centers because of the weakened state of the trees.

Precipitation in the 1990's was below average. Over several years, coupled with higher than historical stocking levels, this can have a negative effect on stand growth. Trees become more likely to sustain significant damage from insects during or following drought cycles. Forest stands that have southeasterly to westerly aspects are particularly susceptible to problems associated with drought because of the drying effects of direct sunlight and the prevailing winds on these aspects.

Increases in other insects such as fir engraver and Douglas fir beetle often accompany a defoliator outbreak. Insects are often at endemic levels in the forest, but become more apparent and increase in numbers as a defoliator infestation progresses. Often these insects will "finish off" trees previously weakened by other pests or pathogens.

Any combination of the above listed factors could elevate the level of damage from defoliation to mortality. Additional mortality would add to fuel loads already outside their historic range and increase the risk of stand replacement wildfire.

ALTERNATIVES B, C, D, and E

Indirect effects would include enhancement of fire resistant ponderosa pine and western larch, and regeneration of lodgepole pine cover types in the project area. Increased vigor and resistance to damage from fire, insects and disease can be expected in other forest cover types in the project

area. Openings created through removal and prescribed burning would create favorable conditions for establishment of fire resistant species such as ponderosa pine and western larch, as well as lodgepole pine. Retention of ponderosa pine and western larch for seed and shelter trees should increase the percentage of these species in future stands. In areas usually dominated by lodgepole pine, this species would be expected to reestablish rapidly from local seed sources. In areas where ponderosa pine and western larch have been removed these species could be planted to assure reestablishment.

CUMULATIVE EFFECTS – COVER TYPES

ALTERNATIVE A – NO ACTION ALTERNATIVE

Almost every year a wildfire starts somewhere in the American River watershed. Fire spread depends on weather (temperature, wind, and moisture primarily), topography, and fuel. The longer fire or fuel management is absent from an area the greater the total biomass quantity and continuous fuel. When a wildfire starts these factors result in more intense fire behavior and increased resistance to control. With the higher intensity and increased area of a fire, the more vegetation that would be damaged or destroyed. This includes large, old trees, which may have withstood natural intensity fires for centuries.

The implementation of Alternative A (No Action), with current forest conditions (live and dead biomass) outside the historic natural range of variability, provides a greater risk of epidemic stand loss to diseases and insects. In these finite systems of moisture and sunlight only a certain amount of live biomass can be supported per acre. Consequently, the more individual trees on an acre, the smaller the allocation of water and the necessary elements per tree resulting in subsequent lower vigor and growth per individual tree. Plants produce different hormones and other chemicals when growing at various rates that affect the potential size of these plants. Plants that receive more moisture and sunlight grow faster and have the potential to achieve a larger size.

Insect infestation would increase with no management action. Forest stands under stress have a higher potential to attract bark beetles. When trees are stressed they produce chemicals which are natural attraction signals to bark beetles. Bark beetles are a natural thinning agent and a necessary part of the ecosystem in creating habitat for certain wildlife species, and reducing stress for the remaining live trees. With the increase in vulnerable food supplies (stressed trees) insect populations can build to epidemic proportions. Epidemics of beetles can destroy even the healthiest trees due to mass attacks. Bark beetles can also carry spores that inoculate trees with saprophytic microorganisms that can weaken the bole and increases the rate of bole snap and decomposition. This effect would cause many trees (snags) killed by beetles to fall to the ground in a relatively short time decreasing their value for cavity nesters, and increasing the amount of fuel for high intensity wildfire.

The majority of forest stands proposed for treatment in the Crooked River Area are in a state of relatively poor vigor. Trees are generally more susceptible to root rots and disease when at low vigor. With the selection of Alternative A, tree vigor would continue to decline and would likely result in more tree deaths attributable to root rot, especially the more susceptible grand fir and Douglas fir. Parasitic plant dwarf mistletoe would also contribute to decline in Douglas-fir, lodgepole pine, and western larch.

Conifers, especially shade-tolerant species such as Douglas fir and grand fir, would continue to invade historically open forest stands and meadows. Grasses, forbs and shrubs would become depauperate in densely stocked forest stands. Gene pools of various species of plants, especially those dependent on frequent fire regimes, would decline and become less viable.

Reduced acres of lodgepole pine and ponderosa pine cover types can be expected in time due to mountain pine beetle induced mortality and forest succession favoring establishment of climax

species. Western larch cover type can also be expected to decrease over the long term. Mixed conifer cover type could be expected to increase.

ALTERNATIVE B

Implementation would affect forest cover types on 581 acres in the drainage. Other activities and ongoing hazard tree removal and firewood cutting also have potential to affect forest cover types on additional acres in the drainage.

ALTERNATIVE C

Implementation would affect forest cover types on 718, acres in the drainage (approximately 1 percent). Other activities in the drainage and ongoing hazard tree removal and firewood cutting also have potential effects to forest cover types on additional acres in the drainage.

ALTERNATIVE D

Implementation would affect forest cover types on 966 acres in the drainage. Other activities in the drainage, including the proposed Whiskey Gulch Fuel Reduction projects, and ongoing hazard tree removal and firewood cutting also have potential effects to forest cover types on additional acres in the drainage.

ALTERNATIVE E

Implementation would affect forest cover types on 310 acres in the drainage. Other activities in the drainage, including the proposed Whiskey Gulch Fuel Reduction projects, and ongoing hazard tree removal and firewood cutting also have potential effects to forest cover types and structure on additional acres in the drainage.

IRREVERSIBLE OR IRRETRIEVABLE EFFECTS – COVER TYPES

There are no irreversible or irretrievable effects to cover types associated with any of the alternatives. All action Alternatives would temporarily affect herbaceous cover types, short-lived fire susceptible, and mixed conifer cover types. However, vegetation normally present in those types would reclaim those areas though forest succession.

STRUCTURE

DIRECT EFFECTS – SIZE CLASS

ALTERNATIVE A – NO ACTION ALTERNATIVE

There are no direct effects to size classes associated with this alternative.

ALTERNATIVE B

Direct effects to tree size classes would include an increase in seedling/sapling size classes on approximately 292 acres in clearcut and seed tree areas. Pole through medium size tree classes would be reduced on 528 acres. Large tree (21 + inch DBH) size classes would remain essentially the same except for incidental removal for temporary road construction and line corridors. Figure 3.12 displays direct effects of implementation of Alternative B to tree size classes in the project area.

ALTERNATIVE C

Direct effects to tree size classes would include an increase in seedling/sapling size classes on approximately 357 acres in clearcut and seed tree areas. Pole through medium size tree class acres would be reduced on approximately 661 acres. Large tree (21 + inch DBH) size classes would remain essentially the same except for incidental removal for temporary road construction

and line corridors. Figure 3.12 displays direct effects Alternative C to tree size classes in the project area.

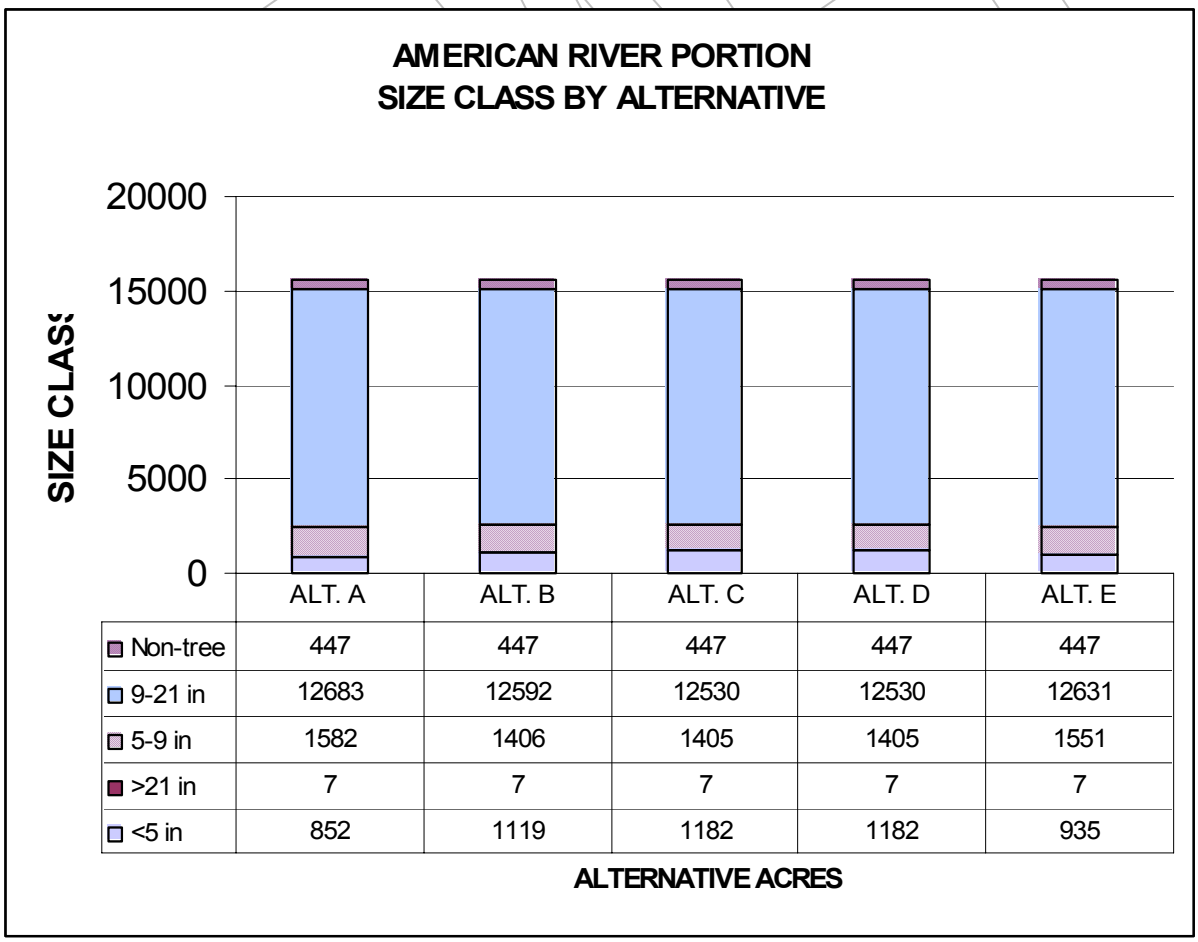
ALTERNATIVE D

Direct effects to tree size classes include an increase in seedling/sapling size classes on approximately 357 acres in clearcut and seed tree areas. Pole through medium size tree class acres would be reduced on 910 acres. Large tree (21 + inch DBH) size classes would remain essentially the same except for incidental removal for temporary road construction and line corridors. effects Alternative C to tree size classes in the project area. Figure 3.12 displays direct effects of implementation of Alternative D to tree size classes in the project area.

ALTERNATIVE E

Direct effects to tree size classes include an increase in seedling/sapling size classes on approximately 77 acres in clearcut and seed tree areas. Pole through medium size tree class acres would be reduced on 300 acres. Large tree (21 + inch DBH) size classes would remain essentially the same except for incidental removal for temporary road construction and line corridors. Figure 3.12 below displays direct effects of implementation of Alternative E to tree size classes in the project area.

Figure 3.12: AMERICAN RIVER SIZE CLASS BY ALTERNATIVE



	ALT. A	ALT. B	ALT. C	ALT. D	ALT. E
Non-tree	447	447	447	447	447
9-21 in	12683	12592	12530	12530	12631
5-9 in	1582	1406	1405	1405	1551
>21 in	7	7	7	7	7
<5 in	852	1119	1182	1182	935

Table 3.89: American River Proportion of Existing Size Class

SIZE CLASS	ALT. A	ALT. B	ALT. C	ALT. D	ALT. E
<5 in	1	0.76	0.72	0.72	0.91
>21 in	1	1.00	1.00	1.00	1.00
5-9 in	1	1.13	1.13	1.13	1.02
9-21 in	1	1.00	1.00	1.00	1.00
Non-tree	1	1.00	1.00	1.00	1.00

INDIRECT EFFECTS – SIZE CLASS

ALTERNATIVE A – NO ACTION ALTERNATIVE

Size class diversity would temporarily increase as shade tolerant grand fir and subalpine fir establish and maintain in stands in the project area. Small and medium trees would dominate creating continuous fuel ladders, increasing the potential for severe fire. Large fire resistant ponderosa pine and western larch would eventually be excluded due to stress induced by competition for water and nutrients, lack of suitable conditions for regeneration, or severe fire. In time, there is a high probability severe fire would occur, resulting in reestablishment of single size class stands in burned areas.

ALTERNATIVES B, C, D, AND E

Indirect effects associated with harvest and fuel reduction treatments would be increased growth and vigor, as well as resistance to damage from fire to remaining trees. Remaining trees in all size classes would benefit through reduced competition for sunlight, water, and nutrients.

CUMULATIVE EFFECTS – SIZE CLASS

ALTERNATIVE A – NO ACTION ALTERNATIVE

There are no cumulative effects to size classes in the American River Drainage associated with alternative one.

ALTERNATIVE B

Size classes would be affected on approximately 581 acres (1 percent) of the American drainage.

ALTERNATIVE C

Size classes would be affected on approximately 718 acres (1 percent) of the American drainage.

ALTERNATIVE D

Size classes would be affected on approximately 966 acres (2 percent) of the American drainage.

ALTERNATIVE E

Size classes would be affected on approximately 310 acres (1 percent) of the American drainage.

IRREVERSIBLE OR IRRETRIEVABLE EFFECTS – SIZE CLASS

There are no irreversible or irretrievable effects to size classes associated with any of the alternatives. Alternatives B,C,D, and E would have some effects on size classes in the project area, though this would be temporary.

DRAFT

STAND DENSITY

DIRECT EFFECTS – STAND DENSITY

ALTERNATIVE A – NO ACTION ALTERNATIVE

There are no direct effects to stand densities associated with this alternative.

ALTERNATIVE B

Direct effects would be reduced stand densities on approximately 725 acres in the project area. Stand densities would be reduced approximately 90 percent on clearcut acres, 80 percent on seed tree, 70 percent on shelterwood, 50-60 percent on thinning acres, and 10 percent on roadside salvage acres.

ALTERNATIVE C

Direct effects would be reduced stand densities on approximately 875 acres in the project area. Stand densities would be reduced approximately 90 percent on clearcut acres, 80 percent on seed tree, 70 percent on shelterwood, 50-60 percent on thinning acres, and 10 percent on roadside salvage acres.

ALTERNATIVE D

Direct effects would be reduced stand densities on approximately 1103 acres in the project area. Stand densities would be reduced approximately 90 percent on clearcut acres, 80 percent on seed tree, 70 percent on shelterwood, 50-60 percent on thinning acres, and 10 percent on roadside salvage acres.

ALTERNATIVE E

Direct effects would be reduced stand densities on approximately 444 acres in the project area. Stand densities would be reduced approximately 90 percent on clearcut acres, 80 percent on seed tree, 70 percent on shelterwood, 50-60 percent on thinning acres, and 10 percent on roadside salvage acres.

Table 3.90 displays direct effects of implementation of alternatives B,C,D, and E to tree stand densities in the project area. Stand densities are calculated for previously unmanaged stands in the project area.

Table 3.90: Action Alternatives - Change in Stand Densities

Size Class	Current Trees/acre	Alt. B,C,D,E Trees/Acre	Percent Change
Seedling/Sapling	1,300	1,300	0%
Pole (5-9 inch DBH)	66	7	90%
Small Tree & Medium Tree (9-21 inch DBH)	53	7	90%
21 + inch DBH	5	5	0%

INDIRECT EFFECTS – STAND DENSITY

ALTERNATIVE A – NO ACTION ALTERNATIVE

Stand densities would increase in the short term as lodgepole stands are replaced by grand fir and subalpine fir. Increased stand densities would result in increased fuel loading and potential for intense fire activity. Barring fire, insect or disease epidemics, stand densities would decrease as stands mature and competition results in stem exclusion.

ALTERNATIVES B, C, D, AND E

Increased vigor and resistance to damage from fire, insects and disease would expected for all tree species in the harvest and fuel reduction areas. Reduced densities and underburning would create openings and favorable conditions for establishment of fire resistant seral species such as ponderosa pine and western larch. In areas usually dominated by lodgepole pine, this species would be expected to reestablish rapidly from local seed sources. In areas where ponderosa pine and western larch have been reduced, these species could be planted to assure reestablishment. Increased potential for wind damage may occur in some areas. However this would be minimized through project design to protect remaining trees in those areas.

CUMULATIVE EFFECTS – STAND DENSITY

ALTERNATIVE A – NO ACTION ALTERNATIVE

There are no cumulative effects to stand densities associated with this alternative.

ALTERNATIVE B

Stand densities would be reduced on approximately 755 acres of previously unmanaged stands in the drainage. This would change stand densities in approximately .8 percent of the drainage

ALTERNATIVE C

Stand densities would be reduced on approximately 875 acres of previously unmanaged stands in the drainage. This would change stand densities in approximately .9 percent of the drainage.

ALTERNATIVE D

Stand densities would be reduced on approximately 1103 acres of previously unmanaged stands in the drainage. This would change stand densities in approximately 2.1 percent of the drainage

ALTERNATIVE E

Stand densities would be reduced on approximately 444 acres of previously unmanaged stands in the drainage. This would change stand densities in approximately .4 percent of the drainage.

IRREVERSIBLE OR IRRETRIEVABLE EFFECTS – SIZE CLASS

There are no irreversible or irretrievable effects to stand densities associated with any of the alternatives. Alternatives B, C, D, and E would reduce stand densities in the project area, though this effect would be temporary.

3.10.1.2. INDICATOR 2 – DISTURBANCE PATTERNS

INSECTS AND DISEASE

MOUNTAIN PINE BEETLE

Mountain pine beetle is a native bark beetle with a one- to two-year life cycle that is the prime insect agent affecting lodgepole pine ecosystems Adults select green trees of sufficient size and phloem thickness to nourish their larvae. The pitch tubes on the bole and boring dust at the base of the tree are evidence of beetle entry. Beetles are subject to mortality from parasites, predators such as woodpeckers, cold winters, drying of the pine following infection, and resin from the host tree. Infestations tend to occur at 20 to 40 year intervals, depending on the age, size, and density of lodgepole stands (Cole and Amman, 1980). A prior beetle outbreak occurred in the 1980s in American and Crooked River, followed by salvage and logging. This approach to beetle treatment favors rapid reestablishment of lodgepole pine and renewal of the cycle. Salvage, thinning and

prescribed fire, augmented by planting beetle- and fire-resistant species could help interrupt some continuity of dense lodgepole pine and slightly reduce susceptibility to this cycle. Thinning can help reduce susceptibility to mountain pine beetle through both physiological response of the remaining trees and changed microclimate within the stand (Mitchell, 1994).

Lodgepole pine is characteristic of interior montane basins like American and Crooked River where cold air impoundment favors establishment of the species. Lodgepole in American and Crooked River has become highly susceptible to mountain pine beetle because much of the lodgepole derives from fires between 1870-1898 and these trees have reached an age and size suitable for beetle reproduction. In the absence of fires, landscape patterns may have taken a different course of development and large contiguous areas of susceptible lodgepole may not have developed.

Mountain pine beetle infestations can kill 30 to over 90 percent of trees 5 inches or larger in a stand, but trees 8 inches or larger are preferred. After each infestation, residual lodgepole pine and shade tolerant species like grand fir increase their growth and the trend is toward uneven-age stands with multiple canopy layers and shade tolerant species. This has been observed in response to the 1980s epidemic in American and Crooked River. In mixed lodgepole and ponderosa pine stands, beetles may attack both lodgepole and ponderosa pine. At several low elevation sites I the project area mountain pine beetle has killed noticeable amounts of ponderosa pine.

WESTERN BALSAM BARK BEETLE

This beetle is a native wood-boring insect that attacks subalpine fir, and rarely Engelmann spruce (Garbutt, 1992, as cited in Natural Resources of Canada, 2003). In American and Crooked River they have been identified in the upper elevation spruce-fir stands, but numbers of affected trees are currently relatively low. Their successional function is to kill old subalpine fir, favoring establishment of new subalpine fir. This may not change Cover Types, but can contribute to development of more uneven-age structure, and fuel accumulations. It is estimated that this beetle is at endemic levels and will remain so unless environmental factors change significantly.

BALSAM WOOLLY ADELGID

This is a sucking insect introduced from Europe that is now found in the American and Crooked River watershed in a few areas, but the extent to which it may increase in population and activity is not known. Stem attacks can lead to eventual tree mortality. Crown attack can ultimately affect bud formation and upward growth and can also lead to tree mortality. This insect more often attacks young trees so its successional effect is to reduce stand density and reduce vertical canopy layering by affecting understory fir. Cold winters control populations, while warm summers favor their survival.

DOUGLAS FIR BEETLE

This is a native bark beetle that is not typically very aggressive and usually attacks wind thrown, fire-damaged trees or trees weakened by other pathogens or drought (Hagle et al., 1987, Schmitz and Gibson, 1996). Where Douglas fir occurs with early seral larch or pine, beetle activity will help maintain the early seral species. On grand fir and subalpine fir habitat types, like those that dominate American and Crooked River, Douglas fir beetle activity creates openings where more shade-tolerant species like grand fir will grow and push the stand more quickly toward late seral conditions and uneven aged stand structure (Hagle et al., 2000). Observed pockets of Douglas fir beetle in the watershed have been small and occur in areas where past fires were not stand replacing so that large old Douglas fir remain. Many of these pockets are associated with old growth and will provide large Douglas fir snags.

Because of extensive fire in the late 1800s and subsequent harvest, large Douglas firs in dense stands are not abundant in the watershed so the potential for extensive beetle outbreaks is relatively low.

ROOT DISEASES

Root diseases are fungi that can affect all sizes, ages and species of tree (Hagle et al., 1987, Hagle et al., 2000). In the watershed, grand fir and Douglas-fir are most highly susceptible and the prevailing root pathogens affecting them are armillaria and annosus root rots. With the loss of lodgepole pine to mountain pine beetle, grand fir and subalpine fir will increase, and root disease will likely also increase. However this change is not toward conditions that are outside historic ranges. Where Douglas-fir has encroached on ponderosa pine stands, these will be more susceptible to root disease.

Fire and root disease appear to have contributed historically to the maintenance of larch in mixed conifer stands. Without fire, root disease is unlikely to sufficiently limit grand fir to keep larch from being eventually eliminated.

Root disease has probably increased a small amount in average severity. The older stands become and the more they shift toward grand fir, the more severe root disease will be. Root disease may recover a more important role if lodgepole dominance is reduced and Douglas-fir and grand fir increase. It will affect canopy cover, Cover Types, size, and age distribution of trees, and timber productivity. The effects will be to create forest openings, favoring shrubs and regeneration of more susceptible grand fir or increased dominance by less susceptible species. Over the long term, without fire or harvest to sustain less susceptible species, more tree species will become susceptible.

BLISTER RUST

Virtually no western white pine or whitebark pine has been inventoried in the drainage so the potential for blister rust is low. The historic potential for these tree species appears to have been very low also.

DWARF MISTLETOE

Dwarf mistletoes are parasitic plants that extract water and nutrients from living conifer trees (Hagle et al. 2000). Lodgepole pine. Lodgepole pine dwarf mistletoe is the species most active in the American and Crooked River watershed, because of the importance of this cover type. Initial effects are to reduce stand density and size dominance within the affected species and size class. Successional effects where mistletoe is severe are to accelerate succession toward grand fir or subalpine fir. Fires that kill host species also reduce mistletoe.

Overall, dwarf mistletoes affect a relatively small proportion of the American and Crooked River project area. Compared to mountain pine beetle, the effects of dwarf mistletoe in lodgepole pine are likely to be minor. The thinning effect of mountain pine beetle will reduce dwarf mistletoe on lodgepole pine in the American and Crooked River area.

3.10.1.3. INDICATOR 3 – RARE PLANTS

SCOPE OF ANALYSIS

Proposed activities have the potential to affect threatened, endangered or sensitive plant species. The effect on potentially suitable habitat and existing occurrences of sensitive plants are the primary indicators of this analysis. Direct and indirect effects are analyzed within the context of the proposed activities, while cumulative effects are analyzed within the watersheds as a whole.

REGULATORY FRAMEWORK

Threatened and endangered species are designated under the Endangered Species Act. It is the policy of Congress that all Federal departments shall seek to conserve endangered and threatened species and shall utilize their authorities in furtherance of this purpose (ESA 1531.2b). According to U.S. Fish and Wildlife Service list #1-4-04-SP-254 (letter dated 3/05/2004), four plants listed as Threatened or Proposed Threatened may occur within the geographic extent of the Nez Perce National Forest: These plants include Macfarlane's four-o'clock (*Mirabilis macfarlanei*), water howellia (*Howellia aquatilis*), Ute ladies'-tresses orchid (*Spiranthes diluvialis*) and Spalding's catchfly (*Silene spaldingii*). According to the 90-Day Species list update, the four plants, including their habitat, mentioned above are not found on the Red River District. Therefore a biological Assessment for the project proposal is not necessary.

Sensitive species are defined in the Forest Service Manual (FSM 2670.5) as "those plant and animal species identified by the Regional Forester for which population viability is a concern, as evidenced by significant current or predicted downward trends in population numbers, density, or habitat capability that reduce a species/existing distribution." In FSM 2670.22, management direction for sensitive species is in part, to ensure that species do not become threatened or endangered, because of Forest Service actions and to maintain viable populations of all native species. The most recent update to the sensitive species list was published on March 12, 1999. The Forest Service must evaluate impacts to sensitive species through a biological evaluation.

ANALYSIS METHODS

Pre-field work included review of existing records and forest habitat data. Individual species requirements were summarized and used in selections of modeling criteria to determine which species or corresponding habitat may occur in the project area. The basic criteria used were Habitat Type Groups (HTG) and existing vegetation layer. These vegetation layers were grouped into similar forest habitats into functional categories based upon existing vegetation, vegetation potential, moisture and temperature characteristics. These elements were useful to match species to general habitats found in the project area. In some cases, habitat grouping only provided an indication of the presences of microsites the plant requires.

Using GIS, these habitat groupings important to sensitive plants along known populations were mapped for the project area. Locations of the proposed activities were evaluated against suitable habitat groupings and existing sensitive plant occurrences to determine the impact the actions may have on the suitable habitat and existing populations.

Based on the results of existing records, fieldwork, and habitat modeling, direct and indirect are discussed for each species. Direct impacts include timber harvest, prescribed fire, road construction and restoration activities. Indirect impacts for some species may include the expansion of weeds and the mitigating treatments of these infestations or changes to canopies that affect micro-conditions. Cumulative effects are the overall impacts to species from present and reasonably foreseeable future projects within the watersheds. Historically such impacts on individual species was not measured or noted. However, the past impacts on general habitat condition can be qualified and matched to species dependant on a particular habitat. For this reason the Habitat Type Groups are used in part for the cumulative effects discussion.

EXISTING CONDITION

SENSITIVE SPECIES

According to element occurrence records from the Idaho Conservation Data Center (ICDC), four designated sensitive plant species occur in the project area. These are: candystick (*Allotropa*

virgata), Payson's milkvetch (*Astragalus paysonii*), Idaho barren strawberry (*Waldsteinia idahoensis*) and deerfern (*Blechnum spicant*). Field surveys during the 2003 field season found additional occurrences of *Allotropa virgata* and *Waldsteinia idahoensis.* A fifth sensitive plant species, evergreen kittentail (*Synthyris platycarpa*) is known from areas adjacent to the project area.

In addition, *Corydalis caseana hastata*, a regional endemic can occasionally be found along small streams and wetlands. *Carex californica*, a relatively rare sedge, is scattered in the upper montane grasslands along the Anderson Butte ridge.

The following table includes the sensitive plants found within the watersheds and those that may have potential habitat in the project area. Sensitive species not included are not known or suspected to occur in the area, nor is suitable habitat present. Potential habitat is based primarily upon Habitat Type Groups (HTGs) and existing vegetation, but most species have at least some more refined parameters that aid in identification of suitable habitats. The acres of suitable habitat given are for the project area only. Discussions of suitable habitat on a watershed level in relation to this and other projects are found in the Cumulative Effects section.

Table 3.91: Known and Potential Sensitive Plants within the Project Area.

Common and Latin Name	Presence	Habitat/Community Type	Elevation (ft)	Potential Habitat
Candystick *Allotropa virgata*	Known	Lodgepole with beargrass on well-drained infertile soils. Often on or near the ridge.	5,000-6,500	11,800
Payson's milkvetch *Astragalus paysonii*	Known	Openings/gaps in mixed grand fir and Douglas fir forests.	4,000-5900	5,000
Deerfern *Blechnum spicant*	Known	Moist riparian forests.	2,500-5,000	3,000
Idaho barren strawberry *Waldsteinia idahoensis*	Known	Meadow edges and open forests of moist/cool grand fir, subalpine fir and cedar.	3,000-5,500	15,000
Botrychium lanceolatum var lanceolatum *Botrychium minganense* *Botrychium pinnatum* *Botrychium simplex*	Potential	Shaded moist sites under various conifers; dry to moist meadows.	1,500-6,000	3,000
Leafless bug-on-a-stick *Buxbaumia aphylla*	Potential	Open parklands on moist acidic soil in upper montane to subalpine zones	Above 5000	3000
Green bug-on-a-stick *Buxbaumia viridis*	Potential	Moist grand fir or cedar forests on large decayed logs and ash soils.	1,500-6,000	18,000
Clustered lady's-slipper *Cypripedium fasciculatum*	Potential	Partial shade of warm and moist cedar, grand fir or Douglas fir.	1,600-4,800	13,500
Evergreen kittentail *Synthyris platycarpa*	Potential	Forest openings, partial shade of grand fir mosaic. Sometimes in cedar and old growth.	4,200-6,000	7,000

CANDYSTICK (*ALLOTROPA VIRGATA*)

This species is a coastal disjunct that occurs in Region one in central Idaho and adjacent Montana. On the Nez Perce National Forest, candystick inhabits sites with mature (80-100 years) lodgepole pine stands over a beargrass/grouse whortleberry or huckleberry understory with little climax conifer regeneration. Physical characteristics are generally well-drained soils on drier, south facing

ridges between 4,000 and 7,000 feet elevation (Lichthardt and Mancuso 1991). These parameters can vary slightly across its geographic range.

Candystick is a mycotrophic plant that obtains its carbohydrates from a mycorrhizal fungus associated with its roots (Lichthardt 1995). The fungal mycelium is shared with a photosynthesizing plant that indirectly supplies nutrients to the mycotroph via the fungus. In this case the photosynthesizing plant is lodgepole pine. For this reason, candystick is limited to forest habitats in which lodgepole pine are dominant or in a few cases at least a significant component.

The Conservation Strategy for *Allotropa virgata* (Candystick) (Lichthardt 1995) was written to provide recommendations for the management of forest lands that support or adjoin populations of this sensitive species. This strategy categorizes occurrences into landscape-scale units, which are prioritized by the quality and extent of habitat, population size and geographic location. Populations in category 4 contain scattered individuals that are not in critical geographic locations, and are in suboptimum habitat. General management recommendations for Priority 3-4 occurrences are to monitor impacts to subpopulations and to manage for lodgepole pine over the long-term.

In the Crooked River watershed, candystick occurrences appear to be scattered in the eastern portion of the project area. Populations can be very small ranging from one stem to dozens of clumps spread over several acres. There are 20 occurrences documented in the American River and Crooked River Watersheds. Eighteen of the 20 are found in the Crooked River Watershed.

Potential habitat was modeled using habitat type groups 3 and 9 that contained existing vegetation of mixed conifer or lodgepole pine between an elevation of 5000-6500 feet.

Approximately 11,800 acres (35 percent) of suitable habitat are found in the project area. Much of this area would not be considered suitable habitat for candystick, but could include microsites that may support appropriate habitat conditions.

PAYSON'S MILKVETCH (*ASTRAGALUS PAYSONII*)

Payson's milkvetch has an unusual range limited to western Wyoming and north central Idaho. On the Nez Perce National Forest it is predominantly found across the American River, Crooked River and Red River watersheds. It is also found occasionally scattered from the breaks of the Selway River to the Breaks of the Salmon River. The plant prefers early seral habitats, which are maintained by fire and other stochastic events and by human-caused disturbances such as timber harvest. Lorain (1990) noted that populations are most prevalent in the grand fir habitat types, but which are currently dominated by other seral species. In general the species seems to be very sparsely spread through open forests. Upon disturbance that results in soil exposure and opening of the canopy, the species blooms from the seed bank. Historically the primary disturbance would have been wildfire. The development of forest openings and gaps is an important factor in maintaining Payson's milkvetch populations across broad geographic areas.

According to CDC (2002) records, there are six occurrences of Payson's milkvetch in the American River watershed within Box Sing Creek, Flint Creek, Big Elk Creek, and Upper American River drainages. These populations are generally small in extent and made up of a few individuals. Most occur in forest openings or edges of logging units, usually on granitic soils.

Potential habitat for Payson's milkvetch within the project area would be characterized as openings and burn areas within HTG2, HTG3 and the dryer end of HGT4 below 5900 feet elevation. Approximately 5,000 acres of suitable habitat is scattered across the project area.

DEERFERN (BLECHNUM SPICANT)

Deerfern is a coastal disjunct species of maritime climates in north Idaho. It is generally found in mid-elevation, moist, mineral rich soils of shaded western red cedar and western hemlock habitats.

Rarely the species occurs in wet areas of other series (Blake and Ebrahimi 1992). It has a strong affinity for draws and riparian areas where it prefers the slope above and adjacent to the wettest plant communities. It rarely forms a part of these wet communities, but is usually associated with the slightly less mesic maidenhair fern and wild ginger.

One population of Deerfern occurs in the East Fork of American River and Red River Watersheds. Both sites are found in moist microsites associated with riparian bottoms within moist grand-fir habitat (HTG 4) with existing vegetation of mixed conifer or lodgepole pine.

Potential habitat within the project area could be generally described as riparian areas in moist Grand-fir (HTG 4) below 5,500 feet elevation.

LANCE-LEAF MOONWORT (*BOTRYCHIUM LANCEOLATUM*), MINGAN MOONWORT (*B. MINGANENSE*), NORTHERN MOONWORT (*B. PINNATUM*), LEAST MOONWORT (*B. SIMPLEX*)

Little is known about the moonworts on the Nez Perce National Forest. Six occurrences have been found on the Forest, all above 3,000 ft. elevation. Throughout the west general habitat for moonworts varies widely from dry meadows, grass/forb openings, lodgepole pine and Englemann spruce to dry grand fir. In northern Idaho most moonworts are associated with riparian areas and moist sites under old western red cedar (Mousseaux 1996). In general the best habitats are typically older, moist forests and dry meadows. In 2003, an occurrence of least moonwort was in found in the Red River watershed in a slightly raised, dry portion of a meadow. Grasses and woods strawberry dominate the ground cover.

All *Botrychium* species are believed to be obligately dependent on mycorrhizal relationships. The subterranean generation depends on fungus for nutrients, while the roots of the above ground generation lack root hairs and probably depend on the fungus for absorption of water and minerals (Chadde and Kudray 2001). Little is known about the mycorrhizal fungi associated with *Botrychium* species other than their presence with the two generations.

The mycotrophic condition is important to the ecology of *Botrychium* species in several ways. Nutrition supplied through a fungal symbiont may allow the ferns to withstand repeated herbivory, prolonged dormancy, or growth in dense shade (Kelly 1994, Montgomery 1990). The fungal/fern relationship has implications for the occurrence of genus communities, the distribution of the species across the landscape, and associations with particular vascular moonworts and strawberries (Wagner, 1999). Botrychiums may exist underground for many years before an above ground plant develops.

The variable habitats and mycorrhizal associations make predictions on suitable habitat extremely difficult. Warm and moist forest floors along riparian areas, dry meadows and grass/forb openings have the highest probability of containing suitable habitat for moonworts

Potential habitat was model from warm and moist habitat type groups and lower slope position, below 6000 ft elevation. This analysis revealed approximately 3000 acres (8 percent) of potential habitat in the project area.

LEAFLESS BUG-ON-A-STICK (*BUXBAUMIA APHYLLA*)

Leafless bug-on-a-stick is rare and local, but widely distributed moss in the northern hemisphere across much of Canada, northern United States and Europe (Crum and Anderson 1981). It has been described as a pioneer species of disturbed, acid, sandy or clayey soils, often on the banks of roads or woodland trails, sometimes on old logs or stumps, exposed or in partial shade in moist forests and also dry, open woods, often successional to fire (Crum and Anderson 1981).

There is a single population known in Idaho, which is on the Nez Perce National Forest. The site is described as being on moist soil at approximately 5,000 feet elevation in open parkland of lodgepole and subalpine fir. The site is in a sheltered position, shaded by the micro-topography and herbaceous layer, rather than the trees (Leonard Lake, Nez Perce NF, personal observation, 1999). Suitable habitat may occur anywhere there is open soil in the middle to higher elevations, but most of this potential habitat would be in the mountain parklands on the edge of the project area.

GREEN-BUG-ON-A-STICK (*BUXBAUMIA VIRIDIS*)

This diminutive moss is found across the Pacific Northwest and Northern Rockies, but is relatively rare to uncommon across its range. In north central Idaho it is found at widely scattered locations on moist sites under mid-to-late seral conifer forests. On the Nez Perce National Forest occurrences are predominately under moist grand-fir canopy on large logs in advanced stages of decay, but may also be found on moist mineral soil derived from volcanic ash.

The most common habitat types for this species in the American River and Crooked River watersheds would be grand fir/arrowleaf groundsel (*Abies grandis/Senecio triangularis*), grand fir/bead lily (*Abies grandis/Clintonia uniflora*) and grand fir/wild ginger (*Abies grandis/Asarum caudatum*) of Habitat Type Group 4 (Warm and Moist Grand Fir) up to an elevation of about 6,000 feet. Substrate availability and distribution and shade (humidity levels) are important habitat elements (Laaka 1992). Though it may occur in microsites of suitable conditions anywhere in the moist forest, the large majority of desirable habitat would be along forested riparian areas and in mesic old growth forest.

Potential habitat was determined using moist or wet forest habitat groups 4, 7, and 8 (grand fir, subalpine fir) and RHCAs below 6,000 feet elevation. Following this model, there are 18,500 acres of potentially suitable habitat in the project area.

CLUSTERED LADY'S-SLIPPER (*CYPRIPEDIUM FASCICULATUM*)

Clustered lady's slipper is a long-lived orchid. It is suspected that the plant can remain dormant underground for an extended period of time. Vegetative plants may live for many years before reaching reproductive maturity and like other orchids it may develop an association with mycorrhizal fungi. The small seed size and lack of endosperm indicate that fungal association is probably necessary for germination and establishment (Lichthardt 1995). This may be an important factor in controlling local distribution.

Typically, clustered lady's slipper grows below a closed canopy in warm, moist sites under a mid-to-late seral conifer community. Where the overstory canopy is more open, clustered lady's slipper is found under a secondary canopy of hardwood shrubs or pole size conifers. Potential habitat for this species varies widely throughout its range. In north central Idaho, most occurrences are in western red cedar habitat types, but a significant number of populations are in assorted Douglas fir and grand fir habitats. Currently, no unique habitat parameter is known that allows biologists to predict future occurrences with more than a very general specificity (Greenlee 1997).

Broad habitat parameters that include warm Douglas fir and warm and moist grand fir (HTG 2 to HTG 4) below 5000 feet that have never had significant disturbance should include most potential habitat. This model indicates there are 13,000 acres of potential habitat, which represents 38 percent of the project area.

EVERGREEN KITTENTAIL (*SYNTHYRIS PLATYCARPA*)

Evergreen kittentails has a very narrow geographic range, being endemic to north-central Idaho, where it occurs mostly in moist grand fir forests (Habitat Type Group 4), but may also occur in cooler western red cedar habitats. The range of evergreen kittentails is strongly associated with

the occurrence of the grand fir mosaic, which is a zone of mid-elevation forest of mainly grand fir, interspersed with alder and bracken fern glades. It is considered an indicator of this ecosystem (Crawford 1980). Occupied sites may be both mature closed-canopy forest and forest openings, such as alder or fern glades, harvest units and roadsides (Lichthardt 1999). An existing occurrence can be found in the Grand-fir mosaic zone of the upper American River Watershed.

Suitable habitat in the upper American River Watershed is represented by 7000 acres of Grand-fir mosaic zone of Moist Grand fir Habitat Type Group (HTG 4) between 4200 and 6000 feet elevation.

IDAHO BARREN STRAWBERRY (*WALDSTEINIA IDAHOENSIS*)

Idaho barren strawberry is endemic to north-central Idaho with populations occurring from the South Fork of the Clearwater River, north to the Coeur D'Alene River. Within this small geographic range it is found in relatively few local areas where it can form extensive populations. The upper South Fork of the Clearwater River including American River, Crooked River and Red River can support relatively large populations.

Idaho barren strawberry has wide ecological amplitude (Crawford 1980) and is found in predominately grand fir/wild ginger and grand fir/queencup bead lily habitat types. However, it also may occur in other grand fir habitats (HTG3 and HTG 4) as well as western red cedar (HTG 5). Elevations generally vary from 2,000 to 5,000 feet (CDC 2002). Cool, moist micro-sites within these general habitats are most favorable for its development (Crawford 1980). Waldsteinia is tolerant of shade but responds favorably to increased light (Crawford 1980). It can be found growing in stands with open canopies, and transition zones between riparian meadows and conifer forests.

Most local occurrences are large and loosely defined. CDC records currently recognize 12 occurrences scattered across the American River and Crooked River Watersheds. The populations are found in dry to moist Grand-fir habitat type groups (HGT 3, HTG4) with existing vegetation of mix conifer to lodgepole pine. All the occurrences are below 5,000 ft.

Close modeling of suitable habitat for this species is difficult due to the broad habitat parameters. However, the general criterion given above occurs across 15,000 acres, which represents 44 percent of the project area.

ENVIRONMENTAL EFFECTS

ALTERNATIVE A – NO ACTION ALTERNATIVE

There will be no management activities under Alternative A that would alter existing canopy cover and stand structure. However, changes in stand structure would be expected, some of which would alter habitats that are suitable for some sensitive plant species. In lodgepole cover types, extensive forest opening may occur as the beetle infestation continues. In more mixed conifer forest types succession will continue to progress resulting in a decline in size and frequency of small openings and forest gaps.

The decrease in forest canopy in lodgepole forests will cause a decline in candystick, but may provide for future habitat as these forests are reinitiated. It is not certain however, how the species may respond to severe fire that may damage soils. The increased intensity of wild fire is possible due to the increased fuel build up in these areas from the beetle mortality. In mixed conifer forests advancing succession would cause a decline in species that require an earlier stage of succession such as Payson's milkvetch and Idaho barren strawberry, but would improve habitat conditions for later seral species such as moonworts, deerfern, clustered lady's-slipper and green-bug-on-a-stick.

ALTERNATIVES B, C, D, AND E (ACTION ALTERNATIVES)

Fifty to seventy-eight percent of the proposed activity units were surveyed in 2003. New occurrences of Idaho barren strawberry (*Waldsteinia idahoensis*) and candystick (*Allotropa virgata*) were documented. No other sensitive plants were found in the project area. A number of candy stick occurrences were found within proposed harvest units.

Decommissioning and reconstruction of existing roads is viewed as maintaining current conditions from the perspective of suitable habitat for rare and sensitive plants. Temporary roads are a direct disturbance to suitable habitats and were included in the disturbance levels for each alternative. Sites of soil restoration generally are not considered suitable habitat for any plant species of concern, thus are not considered when determining impacts. An exception would be Payson's milkvetch, which does find suitable habitat in such areas. The impacts to this species are not quantified because it is benefited by ground disturbing activities in such environments.

Alternative D impacts the most acres of sensitive plant species habitat and would result in the greatest long-term benefit for plant species favored by seral conditions in lodgepole pine.

The acres of sensitive plant species habitat impacted by various management activities are summarized in the following table. The four species of *Botrychium* are grouped due to habitat similarity.

Bug-on-a-stick (*Buxbaumia aphylla*), and Deerfern (*Blechnum spicant)* and Evergreen kittentail *(Synthyris platycarpa)* are not included in the effects analysis because existing information and modeling results indicate that no suitable habitat for these species are being affected by any of the proposed alternatives.

Table 3.92: Comparison of Potential Sensitive Plant Habitat Affected by Alternative

Species	Activity	Alternative B	Alternative C	Alternative D	Alternative E
Candystick *Allotropa virgata*	Crooked R. harvest	974	1027	1370	850
	American Harvest	91	173	178	42
	Total	1065	1200	1548	892
	% habitat affected	9%	10%	13%	7.5%
	Occurrences Affected	**10**	**11**	**11**	**8**
Payson's milkvetch *Astragalus paysonii*	Crooked R. Harvest	630	838	1000	586
	American Harvest	378	569	683	146
	Total	1008	1408	1683	732
	% habitat affected	20%	28%	33%	14%
Moonworts *Botrychium* ssp.	Crooked R. harvest	0	0	0	0
	American R. Harvest	0	0	0	0
	Total	0	0	0	0
	% habitat affected	0	0	0	
Green bug-on-stick *Buxbaumia viridis*	Crooked R. Harvest	222	263	271	176
	American Harvest	210	117	280	151
	Total	432	380	551	327
	% habitat affected	2%	2%	3%	2%
Clustered lady's slipper *Cypripedium fasciculatum*	Crooked R. Harvest	272	300	438	215
	American Harvest	272	371	548	184
	Total	544	671	986	399
	% habitat affected	4%	5%	7%	3%
Idaho Barren Strawberry *Waldsteinia idahoensis*	Crooked R. Harvest	494	726	732	498
	American Harvest	257	388	1276	130
	Total	751	1114	2008	628
	% habitat affected	5%	7%	13%	4%

CANDYSTICK (ALLOTROPA VIRGATA)

Candystick populations would be impacted by timber harvest, road-building and fuels treatment. Generally, the greatest threat to candystick in the Idaho range is habitat loss due to harvest (Lichthardt 1995). Candystick is most common in older lodgepole pine communities, thus successional processes that regenerate lodgepole pine on the landscape are necessary to replenish suitable habitat. Consequently, altered fire regimes brought about through fire suppression may also pose a threat to candystick populations (Lichthardt 1995). The current extensive mortality of lodgepole pine forests will also cause a decline in habitat and the loss of populations as the host trees die. Field surveys in the Red River Watershed have confirmed some candystick losses are occurring as a result of beetle mortality (M. Hays, 2003). The proposed alternatives will affect approximately 7-13 percent of suitable habitat mainly in the Crooked River watershed. In addition 8-11 existing occurrences of Candystick will be directly impacted by timber harvest. Overall a downward trend is expected in candystick populations in the Crooked River Watershed.

The conservation strategy for Candystick (Lichthardt 1995) outlines management considerations for this species. Maintenance of well-distributed subpopulations will provide seed to colonize harvest or burned patches as succession proceeds. Guidelines to manage for future lodgepole pine production are given and include avoidance of impacts to subpopulations of 100 or more genets. These units can also be used to test active management on a limited scale.

Where low levels of beetle infestation make it worthwhile, efforts should be made to place reserve trees or buffers where candystick plants are found within units to maintain the more significant subpopulations as directed by the conservation strategy. This primarily pertains to the occurrences in the Crooked River Watershed. In addition, any occurrences found during implementation that fulfill the Priority 3 guidelines for significance and provide seed for dispersal to future lodgepole habitat created by this project would be protected. The project provides long-term viability of candystick by maintaining or reestablishing lodgepole pine, which the species is dependent for survival, and allowing for stand development to the necessary structure that provides quality habitat for candystick.

PAYSON'S MILKVETCH (ASTRAGALUS PAYSONII)

Timber harvest or road construction may impact suitable habitat in the short term but may provide for new open habitat for future populations. The elimination of disturbances and fire suppression that would result in a decline of early seral communities must also be considered a threat to seral species. With the widespread opening of the forest due to the beetle infestation and harvest activities proposed by this project, it is anticipated that populations of Payson's milkvetch will expand. Current populations can also be put at risk from introduced species, chemical sprays, recreation impacts, and road maintenance (Lorain 1990). It is anticipated that opening these habitats where it occurs will have a beneficial impact.

Temporary road construction, exotic and noxious weeds, and herbicide treatment of noxious weeds, could impact Payson's milkvetch through the elimination of habitat, changes to early seral conditions, or increased mortality (Fertig and Marriott 1993). Exotic species, such as spotted knapweed (*Centaurea maculosa*), Canada thistle (*Cirsium arvense*), and others that establish in harvest units and roadways can out-compete Payson's milkvetch and occupy newly created openings and gaps. Herbicide treatment would not alter suitability of habitat, but may have a detrimental effect on Payson's milkvetch if invasive weeds are mixed with existing populations.

*LANCE-LEAF MOONWORT (*BOTRYCHIUM LANCEOLATUM*), MINGAN MOONWORT (*B. MINGANENSE*), NORTHERN MOONWORT (*B. PINNATUM*), LEAST MOONWORT (*B. SIMPLEX*)*

Threats to species of *Botrychium* are not well understood. The only well-documented threat resulting in a population decline was drought combined with fire (Johnson-Groh and Farrar 1996). Because these species may occur in disturbed sites, threats may include natural plant succession and potentially the same human activities that have also apparently resulted in creation of suitable habitat. Since these species may also be found in forested areas that have not been recently disturbed, forestry activities may affect existing populations negatively, although no research has been reported (Chadde and Kudray 2001). Some threats will directly impact the above ground sporophyte and may be less serious, since the below ground part of the life cycle is so important.

Simple removal of above ground leaf tissue may be inconsequential to the ability of moonworts to survive, although removing sporulating individuals may eventually have an effect through the limiting of recruitment (Johnson-Groh 1999). It has been suggested that photosynthesis may be important and that broad scale leaf removal or damage could threaten *Botrychium* populations (Chadde and Kudray 2001). Mycorrhizae are the most limiting factor for *Botrychium* establishment, distribution and abundance (Johnson-Groh 1999). Therefore adverse impacts to the mycorrhizae may be expected to also have deleterious effects on *Botrychium*.

Even-aged management would have the greatest effect by opening the canopy and disturbing the soil surface. Thinning would maintain enough overstory canopy to sustain suitable habitat, however the skidding of logs and the construction of temporary roads could alter the soil surface and damage the important below ground portion of the plant. By buffering the draws and riparian areas the moist microsites and forest floor where moonworts are most likely to occur would be protected. Due to protection of RHCA's, no management proposed by the action alternatives would occur within suitable portions of *Botrychium* habitat. The meadow portions of moonwort habitat will not be impacted by proposed management activities.

*GREEN BUG-ON-A-STICK (*BUXBAUMIA VIRIDIS*)*

Processes, natural or man-caused, that open the overstory canopy, remove large organic debris, or disturb the soil surface could affect *Buxbaumia viridis* habitat. The species is rare due to inefficient dispersal and by difficulties in establishment (Laaka 1992). Thus it will not cope well with significant impacts to suitable habitat that would change the microclimate (Laaka and Syrjanen 1990). Down log recruitment, a necessary component of *Buxbaumia* habitat would not occur with regeneration harvest. When necessary, mitigation activities should maintain decaying logs and greater than 70 percent closed canopy for shade (FEMAT 1994). Moist riparian bottoms and toe-slopes have the greatest potential for maintaining large decaying logs within grand fir habitats. Protecting draws and riparian areas would protect the moist microsites where large logs are most likely to occur. As a result all alternatives affect an insignicant amount of suitable habitat (2-3 percent)

*CLUSTERED LADY'S SLIPPER (*CYPRIPEDIUM FASCICULATUM*)*

Clustered lady's slipper is sensitive to ground disturbance and canopy removal. Apparent population decreases have been observed where the overstory canopy was reduced (Lake 2001). The few plants found growing in full sunlight had yellowed and deformed leaves. Disturbance to the duff layer that results in exposed soil may also be detrimental to established populations. With even-aged management practices, the mycorrhizal fungal relationships believed to be necessary for seedling germination and health would be severed. Nor would the fungus tolerate the direct sunlight that would result from such activities. The species has never been found in clearcut areas and extirpation would be the expected result of this form of management (Greenlee 1997).

Thinning would maintain enough canopy to sustain suitable habitat, however the skidding of logs and the construction of temporary roads would alter the soil surface and physically remove plants. However, plants have been found persist after some forms of activity that avoid heavy mechanical disturbance and leaves the light, heat and moisture regimes intact. Some populations persist in areas that have undergone low intensity wildfire (Hays 1995) and in areas that underwent some form of intermediate harvest that leaves the duff layer and some cover intact (Lichthardt 2002). It is possible that intermediate harvest treatments in grand fir and Douglas fir habitat types may represent a mixture of detrimental and beneficial effects; in the short term, individuals may be impacted by the timber harvest activities or canopy reduction, but in the long term populations may benefit from the reduced threat of stand replacing fire (Greenlee 1997). The alternatives affect a small percentage (2-7 percent) of suitable habitat for Cluster lady's slipper.

IDAHO BARREN STRAWBERRY (WALDSTEINIA IDAHOENSIS)

Population density of Idaho barren strawberry is greater in open stands with past harvest and in old burns as compared to a more shaded closed conifer community (Crawford 1980). It is capable of colonizing disturbed soils where competition from shrubs and larger plants may be reduced, providing a temporal window for Waldsteinia (Lichthardt 1999). Fire also seems to reduce competition and stimulates both seed and rhizome production. However, prolonged and intense heat that penetrates deeply into the soil may kill the plant (Crawford 1980).

It is difficult to determine long-term population trends for this species. Fire suppression has caused a decline in disturbance, which would be expected to result in some decline. However, large areas of even-aged management, and development of dispersed campsites along stream and meadow margins have increased habitat. If soil surface disturbance is relatively light, Idaho barren strawberry would benefit from the removal of overstory canopy.

IRREVERSIBLE OR IRRETRIEVABLE EFFECTS

None of the alternatives described and analyzed would implement actions or activities that would result in an irreversible commitment of resources as related to threatened, endangered or sensitive plants.

With respect to irretrievable effects, loss of suitable habitat occurs when an area that was once suitable for rare and sensitive plants is no longer available as a result of a series of actions. The no action alternative maintains current habitat conditions for plant species. Management activities create mainly temporary disturbances and any irretrievable effect varies by individual plant species. Proposed activities that affect one species or their habitat negatively may benefit other plants in a positive manner. For example, reducing late seral grand fir to an early seral stage may eliminate clustered lady's slipper from colonizing and making use of the habitat. A series of future activities such as prescribed burning, thinning and other treatment could then render the area unsuitable creating an irretrievable effect on clustered lady's slipper. The same series of action may improve conditions for Payson's milkvetch (*Astragalus paysonii*) or Idaho barren strawberry (*Waldsteinia idahoensis*).

CONSISTENCY WITH THE FOREST PLAN AND ENVIRONMENTAL LAW

As stated under the regulatory framework the objective for managing sensitive species is to ensure population viability throughout their range on National Forest lands and to ensure they do not become Federally listed as threatened or endangered. The forest plan supports this direction but does not set specific standards and guides for sensitive plants. The alternatives are consistent with this direction to the extent that proposed management actions would not adversely affect viability of existing sensitive plant populations.

CUMULATIVE EFFECTS

Cumulative effects for rare and sensitive plants are addressed through consideration of proposed and reasonably foreseeable actions. All reasonably foreseeable actions on lands administered by the Forest Service could require protective measures to avoid negative impacts to sensitive and rare plants. In this analysis cumulative effects to rare plants are discussed in terms of general habitats in the project area and through quantification of modeled habitats potentially affected at the watershed level.

Discussion of cumulative effects for rare and sensitive plants can be addressed through the general trend of habitat type groups found across the American River and Crooked River watersheds as a result of past, present and future management actions. The proposed project area contains several Habitat Type Groups (HTG) used for these discussions that contain the micro-features that are important to the rare and sensitive plants discussed above. These types include: Dry Douglas Fir and Grand Fir (HTG 2), Cool and Dry Grand Fir (HTG 3), Moist Grand Fir (HTG 4), and Cool and moist Subalpine Fir and Spruce (HTG 7). This section focuses on the capability of the habitats to support rare and sensitive plants.

DRY DOUGLAS FIR AND GRAND FIR (HTG 2)

These dry forest habitats are often open and found on south facing slopes of in the north central portion of Crooked River. Habitat types are mostly shrubs and pine grass in the ponderosa pine, Douglas fir and grand fir series. Generally this Habitat Type Group have seen significant management activity over past decades including timber harvest and mining practices. Decades of fire suppression have also increased forest cover in general.

Alternative D, and C would add disturbance to this landscape through timber harvest. So long as proposed management returns these slopes to a more open condition with large dominant pine and soil surface disturbance remains low, the cumulative affect would be an improving trend. However, excessive soil disturbance could depress populations of desirable native species, while encouraging invasion of weeds such as spotted knapweed (*Centaurea maculosa*). Noxious weed treatment may maintain the improving trends if invasive weeds are treated early as small infestations, rather than as dominant plants in susceptible habitat. It is also likely that Payson's milkvetch (*Astragalus paysonii*) and Idaho barren strawberry (*Waldsteinia idahoensis*) would be benefited by management activities that maintain an open stand structure.

COOL AND DRY GRAND FIR (HTG3)

This Habitat Type Group is very common in much of the project area and contains such habitats in the grand fir and Douglas fir series as beargrass (*Xerophyllum tenax*) and twinflower (*Linnaea borealis*) among others that indicate relatively cool and dry sites for these forests types. It is composed of the most common forest habitats in the Crooked River project area with approximately 42,000 acres present.

Much of this zone has seen significant management activity in the past. Seedling and sapling forest structure are increased due to even-aged management. Road densities are relatively high in portions of the zone and some livestock grazing occurs along roads and in forest openings. Exotic plants are scattered along these roads and openings. Mining activity was once common, but is not abundant today. Cool and dry grand fir does not provide habitat for many plant species of concern, but does support habitat and populations of Payson's milkvetch (*Astragalus paysonii*) and Idaho barren strawberry (*Waldsteinia idahoensis*). Seral forests dominated by lodgepole pine provide the necessary habitat for candystick (*Allotropa virgata*).

Disturbance to the landscape through timber harvest and temporary roads are relatively common. The overall effect on potential sensitive plant habitat would be expected to be static to improved conditions. If Payson's milkvetch or Idaho barren strawberry are present in these habitats, both species are well documented to not only withstand disturbance, but generally are increased by it (Crawford 1980). As a result, population viability for these species is not a concern.

Occurrences of candystick are expected to decline in the Crooked River watershed due to extensive lodgepole mortality from a combination of Mountain Pine Bettle, timber harvest, temporary road construction and fuels reduction. Management activity may improve candystick habitat in the long-term by providing future seral lodgepole pine habitats and allowing the Lodgepole to develop into 60-80 year old stands. However, candystick habitat will continue to decline for the foreseeable future and it is unknown at this time the extent of the affects on existing population of this unique plant.

MOIST GRAND FIR (HTG 4)

The Moist Grand Fir Habitat Type Group covers approximately 31,000 acres. The majority is found in the upper American River Watershed. The Grand-fir mosaic is well represented in this HTG and is a common habitat in upper American River Watershed.

Generally this zone has seen significant management activity over past decades. Seedling and sapling forest structure are increased due to even-aged management. Road densities are relatively high in portions of the zone and some livestock grazing occurs along roads, and in forb and alder glades within the Grand-fir mosaic zone. Historic mining has occurred along the main river bottoms of both American and Crooked River watersheds, but this activity is less common today. Exotic plants are present along roads. Moist grand fir provide habitat for deerfern (*Blechnum spicant*), moonworts (*Botrychium* spp.), green bug-on-a-stick (*Buxbaumia viridis*), clustered lady's slipper (*Cypripedium fasciculatum*), evergreen kittentail (*Synthyris platycarpa*), Idaho barren strawberry (*Waldsteineia idahoensis*), and naked-stem rhizomnium (*Rhizomnium nudum*) and ridges dominated by seral lodgepole pine support candystick (*Allotropa virgata*).

Disturbance to the landscape through timber harvest, mining, grazing and roads is relatively common and may continue in the future. Overall effect on potential sensitive plant habitat would be a slight decrease in the amount and quality of suitable habitat. Long-term trends would be static to slightly downward. A slight downward trend in habitat quality would not lead to concerns for population viability since moist grand fir habitats are common in the upper watersheds.

COOL AND MOIST SUBALPINE FIR AND SPRUCE (HTG 7)

These forest habitats are characterized by cool and moist site conditions and support subalpine fir/Menziesia or other moist shrub or forb communities. Approximately 9100 acres of these habitats are common in the upper watersheds of Crooked River and American River. Past land use in these habitats would be similar to those of HTGs 4 with less harvest activity and grazing.

Pact impacts from would be very similar to those described in HTG 4, but the potential to involve sensitive plant species would be much reduced. In these cooler habitats probably only green-bug-on-stick (*Buxbaumia viridis*) and naked rhizomnium (*Rhizomnium nudum*) would potentially be present.

Overall, species with an affinity for early seral conditions and tolerance for light to moderate disturbance, such as Payson's milkvetch and Idaho barren strawberry, will see some benefits from the activities proposed in the action alternatives and future management proposals. Management activities will impact suitable habitat for most of the other sensitive species, but only at very low levels. Candystick provides the most significant botanical consideration associated with these

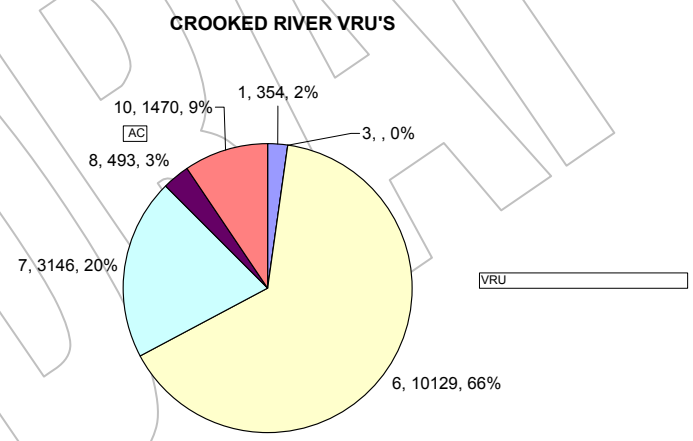
projects because known occurrences will be impacted along with suitable habitat, and it's low tolerance for overstory remove, soil disturbance and changes in stand composition and structure.

3.10.2. CROOKED RIVER

INTRODUCTION

Plant communities in the analysis area can be seen as a mosaic of patches that change in composition, size, and juxtaposition over time. Wildlife and human uses respond to the existing pattern of vegetation. Processes like plant community succession, fire, insect and disease activity, drought and grazing, all change the pattern that exists at any one time. Features like climate, soil, slope, aspect and elevation, control the bounds within which patterns can change. Vegetation Response Units (VRUs), and Potential Vegetation Groups (PVGs), within VRUs are used to describe these bounds. The VRUs for the American River portion of the analysis are shown in figure 3.13. Within these delineations, presettlement processes like climate, fire, and insect and disease activity were likely to operate within somewhat predictable ranges. Understanding how these disturbance regimes worked, and the pattern of vegetation change, is fundamental to management of ecosystems. This understanding can be used to help design management systems that sustain patterns of vegetation at the scale, frequency, and kind of change to which native species are adapted.

Figure 3.13



(*VRU 1*: Convex slopes, subalpine fir ,*VRU 3*: Breaklands, grand fir and Douglas-fir
VRU 6: Cold basins, grand fir and subalpine fir *VRU 7*: Moist uplands, grand fir and Pacific yew)

3.10.2.1. INDICATOR 1 - COMPOSITION (COVER TYPE/SPECIES/LAYER/AGE)

EXISTING CONDITION AND ENVIRONMENTAL EFFECTS

The Crooked River portion of the project area encompasses approximately 23,300 acres. Previous harvest in the project area, dating from the 1950s to the present has occurred on approximately 4,657 acres or approximately 20 percent of the area. Of this approximately 2768

acres were clearcut, 1650 acres were seed tree cuts, 239 acres were thinning/salvage cuts. Figure 3.14 portrays harvest by method, acres and percentage of the analysis area.

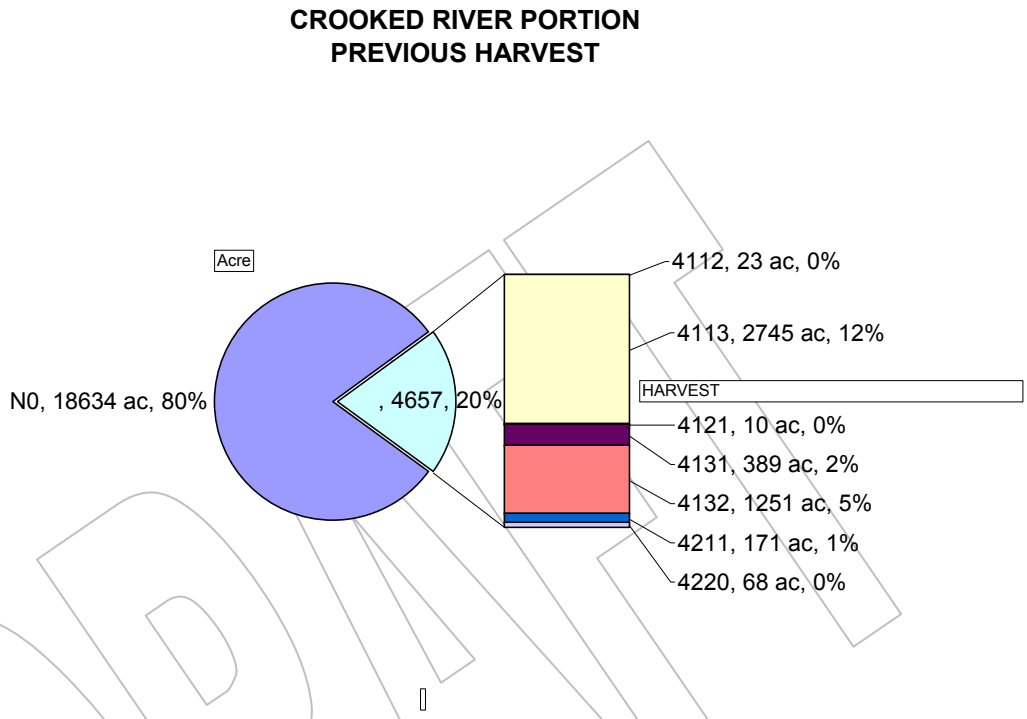


Figure 3.14

(Harvest codes: N0 – no harvest, 4112 – strip clearcut, 4113 – stand clearcut, 4121 – shelterwood prep cut, 4131 - shelterwood seed cut, 4132 – seed tree cut, 4211 – liberation cut, 4220 – thinning)

FOREST COVER TYPES

A combination of wild fire, intentional fire, timber harvest and fire suppression have shaped the existing pattern and composition of vegetation in the analysis area. The greatest changes from historic vegetation conditions include:

Declines in lodgepole pine dominated communities due to harvest, fire suppression and forest succession.

Increases in more shade tolerant tree species, like subalpine fir and grand fir, due to fire suppression and forest succession.

Declines in shrubland, riparian shrub, and riparian meadow due to forest encroachment, agricultural conversion, and forest succession

Whitebark pine has declined seriously from blister rust, fire exclusion and mountain pine beetle. Western white pine, never abundant, has also declined from blister rust.

Early seral structural stages, including forest openings, seedling and sapling, and pole stands, with snags and down wood, have decreased because of fire suppression. Medium and large tree classes have increased in most areas except larch and ponderosa pine forests.

Figure 3.15 and Table 3.93 display project area cover types.

Figure 3.15

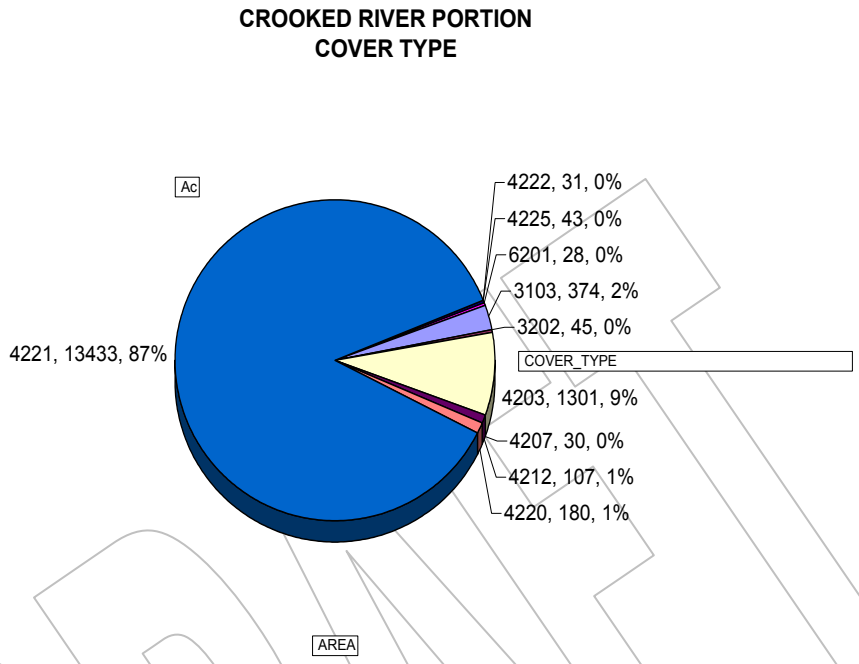


Table 3.93: Cover Type Codes

Code	Cover Type
3103	Herbaceous/low shrub clearcut
3202	Mesic shrub: huckleberry, etc
4203	Lodgepole pine
4207	Grand fir
4212	Douglas fir
4215	Larch
4219	Whitebark pine
4220	Subalpine fir/Engelmann spruce/lodgepole
4221	Mixed conifer (grand fir, Douglas fir and lesser larch and lodgepole
4222	Xeric conifer (ponderosa pine and Douglas fir)
4223	Douglas-fir/lodgepole pine
4224	Burned timber
4225	Larch and grand fir
5201	Water
6101	Riparian conifer (wet spruce fir)
6201	Wet meadow
6202	Riparian shrub

STRUCTURE (SIZE CLASSES, DENSITY AND CANOPY LAYERS)

SIZE CLASSES

Average tree size varies depending on year of origin, tree species, and growing conditions. Approximately 11 percent of the project area consists of regenerating harvest units with tree diameters less than 5 inches and 85 percent of the area supports trees with 5 inches diameter at breast height (DBH) or greater. Less than1 percent of the area supports trees predominantly 21-inches or greater. Small trees (9-14 inch diameter breast height (dbh)) are probably more abundant than typical of a natural landscape. Figure 16 displays existing tree size classes in the project area.

Figure 3.16: Tree Size Classes

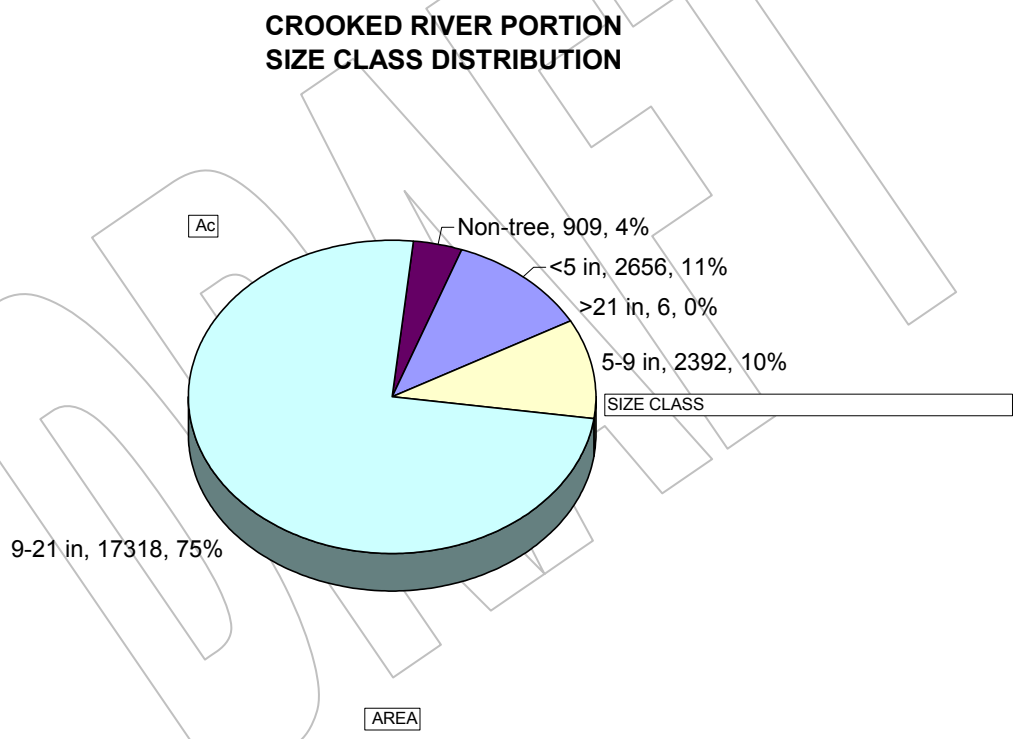
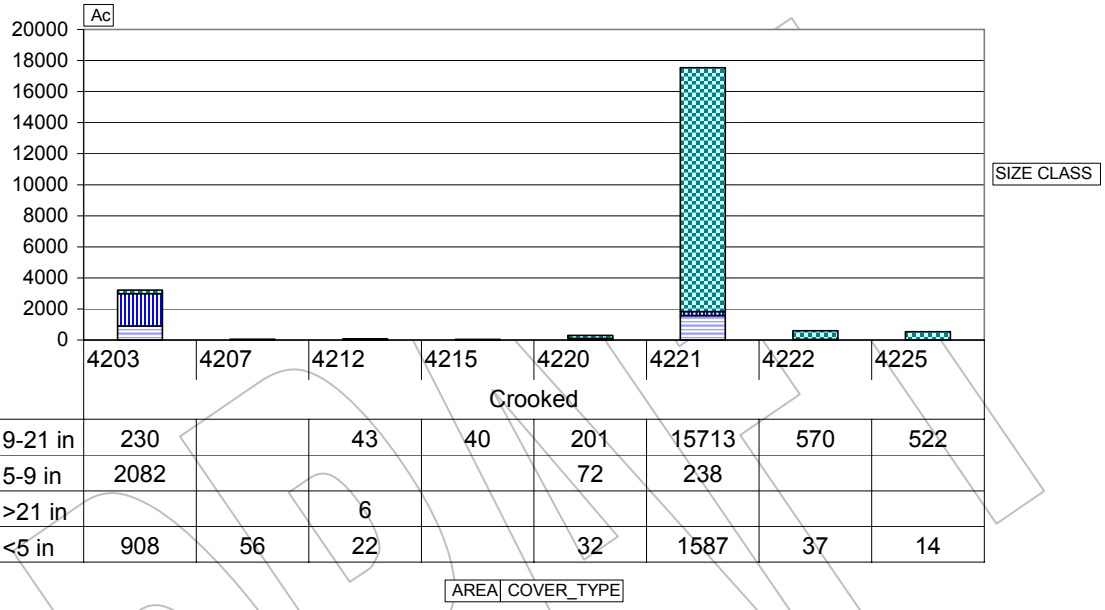


Figure 3.17 displays the current cover type and size class data for the forested area in the Crooked River portion of the analysis area.

CROOKED RIVER PORTION
COVER TYPE/SIZE CLASS



STAND DENSITY

Stand density, measured in trees per acre vary widely across the project area. Variations are due to elevation, aspect, soils and moisture, as well as disturbances such as insect activity, fire and harvest. Stand densities in previously harvested, regenerated stands in the project area range from approximately 1,000 to 4,000 trees per acre of sapling to pole-sized trees in unthinned stands, to approximately 435 trees per acre in thinned stands. Stand densities in the table below have been calculated for previously unmanaged stands in the project area. One consequence of increased stand densities is the increase in fuel loading (tons per acre of vegetative fuel) that could increase fire intensity, severity and resistance to control. Table 3.94 displays average stand densities by size class for previously unmanaged stands in the project area.

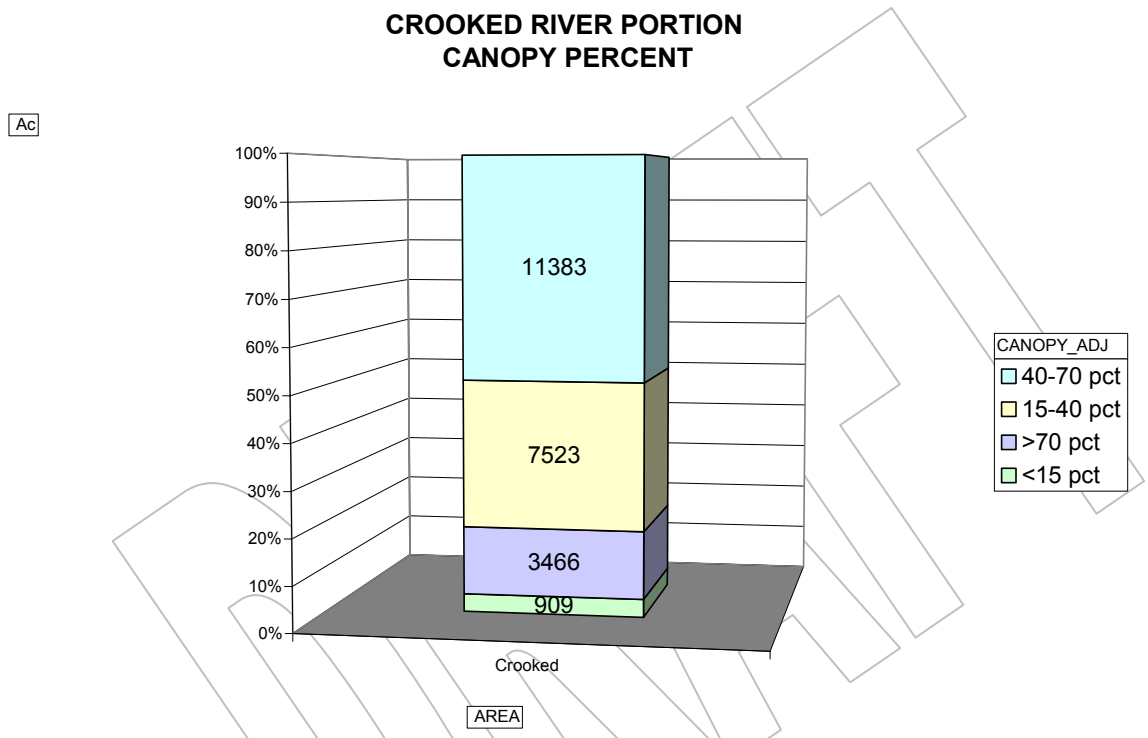
Table 3.94: Unmanaged Stand Densities in the Project Area

Size Class	Trees/Acre	Acres by Size Class	Percent of Project Area
Seedling/Sapling	1,300	2656	11
Pole (5-9 inch DBH)	66	2392	10
Small-Medium Trees (9-21 inch DBH)	53	17318	75
21 + inch DBH	5	6	0
Total (5" DBH and greater)	167	19716	85

CANOPY LAYERS

Relatively simple one and two story stands have transitioned to more complex multi-story stands. Lodgepole pine mortality will accelerate the shift toward multi-story conditions. Figure 3.18 displays canopy cover in the project area.

Figure 3.18



ENVIRONMENTAL EFFECTS

Forest succession, insect and disease activity, timber harvest, fire and fire suppression have resulted in changed cover types and forest structure since presettlement (USDA, 2003). Changes in forest cover types and structure (size class, stand density and canopy layers) are used as indicators to quantify effects on vegetation. Cumulative effects are analyzed within the Crooked River Drainage.

All action alternatives will have some effects to forest cover types and/or stand structure. All action alternatives would reduce the potential for intense fire and severe fire effects to vegetation through fuel removal, as well as reduce the risk of insect or disease outbreaks. The differences between alternatives would be in number of acres treated, treatment types and amount of fuel removal. All action alternatives implement prescribed fire treatments, though many stands in the project area have too much existing fuel (dead material and ladder fuel) to safely allow the use of prescribed burning without prior thinning.

Prescribed harvests will reduce the canopy by approximately 90 percent in clearcuts, 80 percent in seed tree units, 70 percent in shelter woods, and 50 -60 percent on thinned acres.

COVER TYPES

DIRECT EFFECTS – COVER TYPES

ALTERNATIVE A – NO ACTION ALTERNATIVE

There are no direct effects to cover types associated with this alternative. Cover types in the project area would continue to change without direct intervention of man. Changes through time will vary depending on the intensity of disturbances such as fire, weather events, disease, and insect epidemics.

ALTERNATIVE B

Timber harvest and fuel reduction treatments would occur on approximately 1,828 acres. Approximately 690 acres would be clearcut, 503 acres would be shelterwood, 109 acres would be seed tree, 177 acres would be commercially thinned, 332 acres would be in roadside salvage, and 17 acres would be fuel break. Direct effects would include the following changes in cover types in the fuel treatment areas.

Acres of herbaceous clearcut would increase by approximately 799 acres. This acreage would decrease as trees become reestablished on these acres and canopy closure excludes herbaceous ground cover. Most of these acres would move towards short-lived intolerant (lodgepole pine) and mixed conifer cover types over time. Lodgepole pine cover type would be reduced by approximately 368 acres. Mixed conifer cover types would be reduced by approximately 480 acres.

ALTERNATIVE C

Timber harvest and fuel reduction treatments would occur on approximately 1,899 acres. Approximately 784 acres would be clearcut, 523 acres would be shelterwood, 150 acres would be seed tree, 115 acres would be commercially thinned, 326 acres would be in roadside salvage, and 38 acres would be fuel break. Direct effects would include the following changes in cover types in the fuel treatment areas.

Acres of herbaceous clearcut would increase by approximately 898 acres. This acreage would decrease as trees become reestablished on these acres and canopy closure excludes herbaceous ground cover. Most of these acres would move towards short-lived intolerant (lodgepole pine) and mixed conifer cover types over time. Lodgepole pine cover type would be reduced by 405 acres. Mixed conifer cover types would be reduced by approximately 567 acres.

ALTERNATIVE D

Timber harvest and fuel reduction treatments would occur on approximately 2,297 acres. Approximately 804 acres would be clearcut, 659 acres would be shelterwood, 212 acres would be seed tree, 255 acres would be commercially thinned, 329 acres would be in roadside salvage, and 38 acres would be fuel break. Direct effects would include the following changes in cover types in the fuel treatment areas.

Acres of herbaceous clearcut would increase by approximately 1016 acres. This acreage would decrease as trees become reestablished on these acres and canopy closure excludes herbaceous ground cover. Most of these acres would move towards short-lived intolerant (lodgepole pine) and mixed conifer cover types over time. Lodgepole pine cover type would be reduced by 422 acres. Mixed conifer cover types would be reduced by approximately 659 acres.

ALTERNATIVE E

Timber harvest and fuel reduction treatments would occur on approximately 1,623 acres. Approximately 536 acres would be clearcut, 472 acres would be shelterwood, 88 acres would be

seed tree, 177 acres would be commercially thinned, 337 acres would be in roadside salvage, and 17 acres would be fuel break. Direct effects would include the following changes in cover types in the fuel treatment areas.

Acres of herbaceous clearcut would increase by approximately 681 acres. This acreage would decrease as trees become reestablished on these acres and canopy closure excludes herbaceous ground cover. Most of these acres would move towards short-lived intolerant (lodgepole pine) and mixed conifer cover types over time. Lodgepole pine cover type would be reduced by 283 acres. Mixed conifer cover types would be reduced by approximately 388 acres.

INDIRECT EFFECTS – COVER TYPES

ALTERNATIVE A – NO ACTION ALTERNATIVE

Passive management is a conscious decision with short and long-term ecosystem consequences. Preservation of dynamic ecosystems requires precisely timed, effectively planned and implemented actions if desirable characteristics of those ecosystems are to remain intact. Processes will take place whether at the hand of man or at random under the no action alternative. Anticipated effects of processes, which will occur with no human intervention, can provide a benchmark against which to measure effects of active management.

Forest cover types in the project area would shift towards mixed conifer (primarily grand fir and subalpine fir) cover types. Susceptibility to insect attacks and root diseases affecting conifer species would be expected to increase. Ponderosa pine cover types would be expected to decline as climax conifer species eventually dominate stand composition in stands where ponderosa pine now occurs. This has been observed in stands in the Soda and Blanco Creek drainages during field diagnoses in 2003. Forest cover in some areas in these drainages was dominated by large ponderosa pine with shrub, forb and grass ground cover. This cover type was historically maintained by frequent, low severity ground fire. However, large ponderosa pines in these stands are stressed and fading due to overcrowding and competition from other tree species such as grand fir, Douglas-fir and lodgepole pine. These species have established in these stands due at least partly, to the lack of frequent low severity ground fire. As a result many large ponderosa pine in these stands have died within the past several years.

Mountain pine beetle would continue to cause extensive mortality to lodgepole and ponderosa pine in the project area until host depletion results in a decline in the beetle population to endemic levels. Aerial detection surveys have noted a slight decline in numbers of infected trees between 2002 and 2003, due to host depletion of susceptible lodgepole and ponderosa pine. As grand fir, Douglas-fir and subalpine fir establish and dominate in stands previously dominated by lodgepole pine, these species would be highly susceptible to root disease and insect attack, thus contributing to increased fuel loading in these stands.

Fire suppression would continue throughout the project area, allowing fuels to build up and disrupting the natural fire disturbance pattern. Low severity ground fire would not occur in the project area at the scale necessary to maintain ponderosa pine and western larch cover types. At some point, fire would likely reestablish lodgepole pine dominance in areas where seed sources exist and mineral soil is exposed creating favorable seedbeds for conifer reestablishment.

Early seral, shade-intolerant trees such as ponderosa pine and western larch would decrease in numbers while the shade tolerant species Douglas fir and grand fir would increase. The shrub, forb, and grass component of forest stands would continue to decline.

Forest stands where the principle species is Douglas fir, true fir, or Englemann spruce are highly susceptible to outbreaks of defoliators such as western spruce budworm and Douglas fir tussock moth. In recent years portions of the American River have experienced damaging levels of

hemlock lopper. The following factors make such forest stands within the Crooked River analysis area particularly susceptible to attack.

Many forest stands are multi-storied. In a tussock moth or budworm infestation, the larvae feed on new growth of larger trees. As the caterpillars mature, they drop off the tree for a variety of reasons (wind, exhaustion of food supply, etc.). Landing on foliage suitable for foraging (such as Douglas fir or grand fir) results in additional damage.

Older trees in many forest stands are not vigorous. Damage from defoliators, bark beetles, and other insect pests could trigger eventual mortality.

The conifers in many of the forest stands in the Crooked River Analysis Area are stagnant. Many of these trees are particularly vulnerable to defoliator and bark beetle attack.

Root disease is apparent in portions of the planning area. During a defoliator or bark beetle attack mortality is often first noticed in root centers because of the weakened state of the trees.

Precipitation in the 1990's was below average. Over several years, coupled with higher than historical stocking levels, this can have a negative effect on stand growth. Trees become more likely to sustain significant damage from insects during or following drought cycles. Forest stands that have southeasterly to westerly aspects are particularly susceptible to problems associated with drought because of the drying effects of direct sunlight and the prevailing winds on these aspects.

Increases in other insects such as fir engraver and Douglas fir beetle often accompany a defoliator outbreak. Insects are often at endemic levels in the forest, but become more apparent and increase in numbers as a defoliator infestation progresses. Often these insects will "finish off" trees previously weakened by other pests or pathogens. Any combination of the above listed factors could elevate the level of damage from defoliation to mortality. Additional mortality would add to fuel loads already outside their historic range and increase the risk of stand replacement wildfire.

ALTERNATIVES B, C, D, AND E

Indirect effects would include enhancement of fire resistant ponderosa pine and western larch, and regeneration of lodgepole pine cover types in the project area. Increased vigor and resistance to damage from fire, insects and disease can be expected in other forest cover types in the project area. Openings created through removal and prescribed burning would create favorable conditions for establishment of fire resistant species such as ponderosa pine and western larch, as well as lodgepole pine. In areas usually dominated by lodgepole pine, this species would be expected to reestablish rapidly from local seed sources. In areas where ponderosa pine and western larch have been removed these species could be planted to assure reestablishment.

CUMULATIVE EFFECTS – COVER TYPES

ALTERNATIVE A

Every year a wildfire starts somewhere in the Crooked River watershed. Fire spread depends on weather (temperature, wind, and moisture primarily), topography, and fuel. The longer fire or fuel management is absent from an area the greater the total biomass quantity and continuous fuel. When a wildfire starts these factors result in more intense fire behavior and increased resistance to control. With the higher intensity and increased area of a fire, the more vegetation that would be damaged or destroyed. This includes large, old trees, which have withstood natural low intensity fires for centuries. These sites did not typically have continuous areas of dense understories of saplings and poles to provide ladder fuels to the crowns, nor the concentration of live aerial biomass associated with grand fir and Douglas fir. Natural fuel loading that is higher than historic levels, coupled with a dense understory, can create a crown fire condition which is much hotter and

more damaging to plants and soils than the historic natural fire regime which burned ground fuels and grasses.

The implementation of Alternative A (No Action), with current forest conditions (live and dead biomass) outside the historic natural range of variability, provides a greater risk of epidemic stand loss to diseases and insects. In these finite systems of moisture and sunlight only a certain amount of live biomass can be supported per acre. Consequently, the more individual trees on an acre, the smaller the allocation of water and the necessary elements per tree resulting in subsequent lower vigor and growth per individual tree. Plants produce different hormones and other chemicals when growing at various rates that affect the potential size of these plants. Plants that receive more moisture and sunlight grow faster and have the potential to achieve a larger size.

Insect infestation would increase with no management action. Forest stands under stress have a higher potential to attract bark beetles. When trees are stressed they produce chemicals which are natural attraction signals to bark beetles. Bark beetles are a natural thinning agent and a necessary part of the ecosystem in creating habitat for certain wildlife species, and reducing stress for the remaining live trees. With the increase in vulnerable food supplies (stressed trees) insect populations can build to epidemic proportions. Epidemics of beetles can destroy even the healthiest trees due to mass attacks. Bark beetles can also carry spores that inoculate trees with saprophytic microorganisms that can weaken the bole and increases the rate of bole snap and decomposition. This effect would cause many trees (snags) killed by beetles to fall to the ground in a relatively short time decreasing their value for cavity nesters, and increasing the amount of fuel for high intensity wildfire.

The majority of forest stands proposed for treatment in the Crooked River Area are in a state of poor vigor. Trees are generally more susceptible to root rots and disease when at low vigor. With the selection of Alternative A, tree vigor would continue to decline and would likely result in more tree deaths attributable to root rot, especially the more susceptible grand fir and Douglas fir. Parasitic plant dwarf mistletoe would also contribute to decline in Douglas fir, lodgepole pine, and western larch.

Conifers, especially shade-tolerant species such as Douglas fir and grand fir, would continue to invade historically open forest stands and meadows. Grasses, forbs and shrubs would become depauperate in densely stocked forest stands. Gene pools of various species of plants, especially those dependent on frequent fire regimes, would decline and become less viable.

Reduced acres of lodgepole pine and ponderosa pine cover types can be expected in time due to mountain pine beetle induced mortality and forest succession favoring establishment of climax species. Western larch cover type can also be expected to decrease over the long term. Mixed conifer cover type could be expected to increase.

ALTERNATIVE B

Implementation would affect forest cover types on 1,496 acres in the drainage. Other activities in the drainage, including the proposed Whiskey Gulch Fuel Reduction project and ongoing hazard tree removal and firewood cutting also have potential to affect forest cover types on additional acres in the drainage.

ALTERNATIVE C

Implementation would affect forest cover types on 1,574 acres in the drainage. Other activities in the drainage, including the proposed Whiskey Gulch Fuel Reduction projects, and ongoing hazard tree removal and firewood cutting also have potential effects to forest cover types on additional acres in the drainage.

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ALTERNATIVE D

Implementation would affect forest cover types on 1,968 acres in the drainage. Other activities in the drainage, including the proposed Whiskey Gulch Fuel Reduction projects, and ongoing hazard tree removal and firewood cutting also have potential effects to forest cover types on additional acres in the drainage.

ALTERNATIVE E

Implementation would affect forest cover types on 1,290 acres in the drainage Other activities in the drainage, including the Whiskey Gulch Fuel Reduction projects, and ongoing hazard tree removal and firewood cutting also have potential effects to forest cover types and structure on additional acres in the drainage.

IRREVERSIBLE OR IRRETRIEVABLE EFFECTS – COVER TYPES

There are no irreversible or irretrievable effects to cover types associated with any of the alternatives. Alternatives B, C, D, and E would temporarily affect herbaceous cover types, short-lived intolerant, and mixed conifer cover types. However, vegetation normally present in those types would reclaim those areas though forest succession. Alternative A would not have any effects on forest cover types.

STRUCTURE

DIRECT EFFECTS – SIZE CLASS

ALTERNATIVE A – NO ACTION ALTERNATIVE

There are no direct effects to size classes associated with this alternative.

ALTERNATIVE B

Direct effects to tree size classes would include an increase in seedling/sapling size classes on approximately 799 acres in clearcut and seed tree areas. Pole through medium size tree classes would be reduced on 1428 acres. Large tree (21 + inch DBH) size classes would remain essentially the same except for incidental removal for temporary road construction and line corridors

ALTERNATIVE C

Direct effects to tree size classes would include an increase in seedling/sapling size classes on approximately 784 acres in clearcut areas. Pole through medium size tree class acres would be reduced on approximately 1500 acres. Large tree (21 + inch DBH) size classes would remain essentially the same except for incidental removal for temporary road construction and line corridors.

ALTERNATIVE D

Direct effects to tree size classes include an increase in seedling/sapling size classes on approximately 804 acres. Pole through medium size tree class acres would be reduced on 1885 acres. Large tree (21 + inch DBH) size classes would remain essentially the same except for incidental removal for temporary road construction and line corridors.

ALTERNATIVE E

Direct effects to tree size classes include an increase in seedling/sapling size classes on approximately 536 acres. Pole through medium size tree class acres would be reduced on 1236

acres. Large tree (21 + inch DBH) size classes would remain essentially the same except for incidental removal for temporary road construction and line corridors.

Figure 3.19 displays Crooked River size classes by alternative.

Figure 3.19

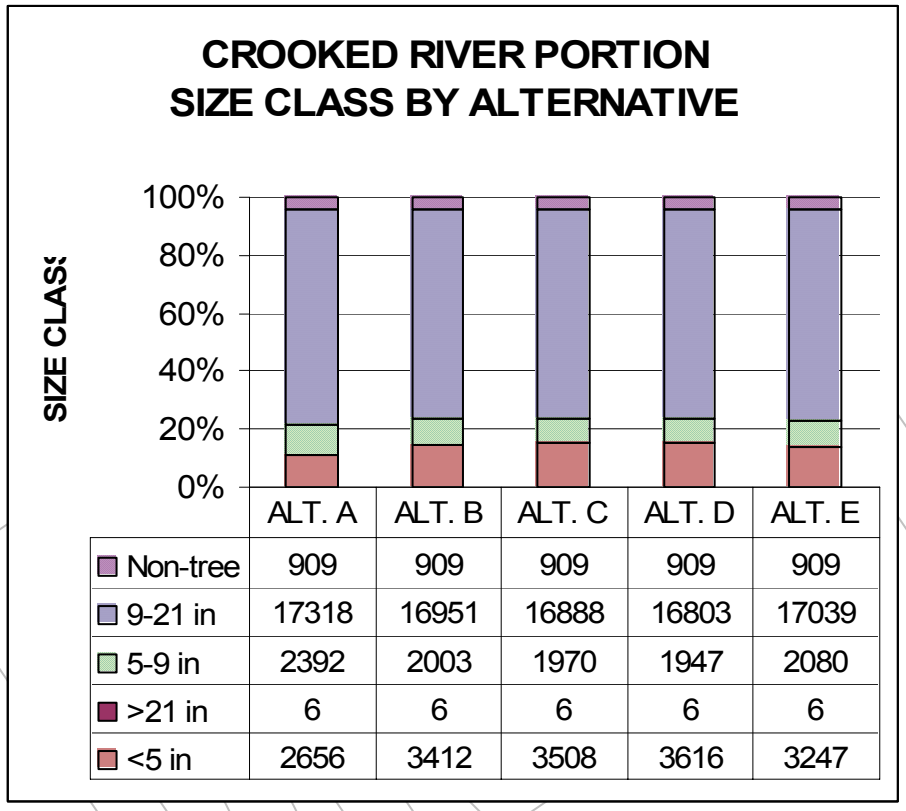

Table 3.95: Crooked River Proportion of Existing Size Class

SIZE CLASS	ALT. A	ALT. B	ALT. C	ALT. D	ALT. E
<5 in	1	0.78	0.76	0.73	0.82
>21 in	1	1.00	1.00	1.00	1.00
5-9 in	1	1.19	1.21	1.03	0.95
9-21 in	1	1.02	1.03	1.01	0.99
Non-tree	1	1.00	1.00	1.00	1.00

INDIRECT EFFECTS – SIZE CLASS

ALTERNATIVE A – NO ACTION ALTERNATIVE

Size class diversity would temporarily increase as shade tolerant grand fir and subalpine fir establish and maintain in stands in the project area. Small and medium trees would dominate creating continuous fuel ladders, increasing the potential for severe fire. Large fire resistant

ponderosa pine and western larch would eventually be excluded due to stress induced by competition for water and nutrients, lack of suitable conditions for regeneration, or severe fire. In time, severe fire would probably occur, resulting in reestablishment of single size class stands in burned areas.

ALTERNATIVES B, C, D, AND E

Indirect effects associated with fuel reduction treatments would be increased growth and vigor, as well as resistance to damage from fire to remaining trees in the fuel reduction areas. Remaining trees in all size classes would benefit through reduced competition for water and nutrients.

CUMULATIVE EFFECTS – SIZE CLASS

ALTERNATIVE A – NO ACTION ALTERNATIVE

There are no cumulative effects to size classes in the Crooked River Drainage associated with alternative one.

ALTERNATIVE B

Size classes would be affected on approximately 1,496 acres 3 percent of the Crooked River drainage.

ALTERNATIVE C

Size classes would be affected on approximately 1,574 acres 3 percent of the Crooked River **drainage.**

ALTERNATIVE D

Size classes would be affected on approximately 1,968 acres 4 percent of the Crooked River drainage.

ALTERNATIVE E

Size classes would be affected on approximately 1,290 acres 3 percent of the Crooked River drainage.

IRREVERSIBLE OR IRRETRIEVABLE EFFECTS – SIZE CLASS

There are no irreversible or irretrievable effects to size classes associated with any of the alternatives. Alternatives B, C, D, and E would have some effects on size classes in the project area, though this would be temporary.

STAND DENSITY

DIRECT EFFECTS – STAND DENSITY

ALTERNATIVE A – NO ACTION ALTERNATIVE

There are no direct effects to stand densities associated with this alternative.

ALTERNATIVE B

Direct effects would be reduced stand densities on approximately 2,010 acres in the project area. Stand densities would be reduced approximately 90 percent on clearcut acres, 80 percent on seed tree acres, 70 percent on shelterwood and fuel break acres, 50-60 percent on thinning acres, and 10 percent on salvage acres..

Alternative C

Direct effects would be reduced stand densities on approximately 2,075 acres in the project area. Stand densities would be reduced approximately 90 percent on clearcut acres, 80 percent on seed tree acres, 70 percent on shelterwood and fuel break acres, 50-60 percent on thinning acres, and 10 percent on salvage acres..

ALTERNATIVE D

Direct effects would be reduced stand densities on approximately 2,509 acres in the project area. Stand densities would be reduced approximately 90 percent on clearcut acres, 80 percent on seed tree acres, 70 percent on shelterwood and fuel break acres, 50-60 percent on thinning acres, and 10 percent on salvage acres..

ALTERNATIVE E

Direct effects would be reduced stand densities on approximately 1,795 acres in the project area. Stand densities would be reduced approximately 90 percent on clearcut acres, 80 percent on seed tree acres, 70 percent on shelterwood and fuel break acres, 50-60 percent on thinning acres, and 10 percent on salvage acres..

Table 3.96 displays direct effects of implementation of alternatives B,C,D, and E to tree stand densities in the project area. Stand densities are calculated for previously unmanaged stands in the project area.

Table 3.96: Action Alternatives Change in Stand Densities

Size Class	Current Trees/acre	Alt. B-5 Trees/Acre	Percent Change
Seedling/Sapling	1,300	1,300	0%
Pole (5-9 inch DBH)	66	7	90%
Small Tree (9-21 inch DBH)	53	7	90%
21 + inch DBH	5	5	0%

INDIRECT EFFECTS – STAND DENSITY

ALTERNATIVE A – NO ACTION ALTERNATIVE

Stand densities would increase in the short term as lodgepole stands are replaced by grand fir and subalpine fir. Increased stand densities would result in increased fuel loading and potential for intense fire activity. Barring fire, insect or disease epidemics, stand densities would decrease as stands mature and competition results in stem exclusion.

ALTERNATIVES B, C, D, AND E

Increased vigor and resistance to damage from fire, insects and disease would expected for all tree species in the fuel reduction areas. Reduced densities and underburning would create openings and favorable conditions for establishment fire resistant seral species such as ponderosa pine and western larch. In areas usually dominated by lodgepole pine, this species would be expected to reestablish rapidly from local seed sources. In areas where ponderosa pine and western larch have been reduced, these species could be planted to assure reestablishment. Increased potential for wind damage may occur in some areas. However this would be minimized through project design to protect remaining trees in those areas.

CUMULATIVE EFFECTS – STAND DENSITY

ALTERNATIVE A – NO ACTION ALTERNATIVE

There are no cumulative effects to stand densities associated with this alternative.

ALTERNATIVE B

Stand densities would be reduced on approximately 2,010 acres of previously unmanaged stands in the drainage. This would change stand densities in approximately 4 percent of the drainage

ALTERNATIVE C

Stand densities would be reduced on approximately 2,075 acres of previously unmanaged stands in the drainage. This would change stand densities in approximately 5 percent of the drainage

ALTERNATIVE D

Stand densities would be reduced on approximately 2,509 acres of previously unmanaged stands in the drainage. This would change stand densities in approximately 5 percent of the drainage

ALTERNATIVE E

Stand densities would be reduced on approximately 1,795 acres of previously unmanaged stands in the drainage. This would change stand densities in approximately 4 percent of the drainage.

IRREVERSIBLE OR IRRETRIEVABLE EFFECTS – SIZE CLASS

There are no irreversible or irretrievable effects to stand densities associated with any of the alternatives. Alternatives B, C, D, and E would reduce stand densities in the project area, though this effect would be temporary.

3.10.2.2. INDICATOR 2 – DISTURBANCE PATTERNS

INSECTS AND DISEASE

MOUNTAIN PINE BEETLE

Mountain pine beetle is a native bark beetle with a one- to two-year life cycle that is the prime insect agent affecting lodgepole pine ecosystems Adults select green trees of sufficient size and phloem thickness to nourish their larvae. The pitch tubes on the bole and boring dust at the base of the tree are evidence of beetle entry. Beetles are subject to mortality from parasites, predators such as woodpeckers, cold winters, drying of the pine following infection, and resin from the host tree. Infestations tend to occur at 20 to 40 year intervals, depending on the age, size, and density of lodgepole stands (Cole and Amman, 1980). A prior beetle outbreak occurred in the 1980s in American and Crooked River, followed by salvage and logging. This approach to beetle treatment favors rapid reestablishment of lodgepole pine and renewal of the cycle. Salvage, thinning and prescribed fire, augmented by planting beetle- and fire-resistant species could help interrupt some continuity of dense lodgepole pine and slightly reduce susceptibility to this cycle. Thinning can help reduce susceptibility to mountain opine beetle through both physiological response of the remaining trees and changed microclimate within the stand (Mitchell, 1994).

Lodgepole pine is characteristic of interior montane basins like American and Crooked River where cold air impoundment favors establishment of the species. Lodgepole in American and Crooked River has become highly susceptible to mountain pine beetle because much of the lodgepole derives from fires between 1870-1898 and these trees have reached an age and size suitable for

beetle reproduction. In the absence of fires, landscape patterns may have taken a different course of development and large contiguous areas of susceptible lodgepole may not have developed.

Mountain pine beetle infestations can kill 30 to over 90 percent of trees 5 inches or larger in a stand, but trees 8 inches or larger are preferred. After each infestation, residual lodgepole pine and shade tolerant species like grand fir increase their growth and the trend is toward uneven-age stands with multiple canopy layers and shade tolerant species. This has been observed in response to the 1980s epidemic in American and Crooked River. In mixed lodgepole and ponderosa pine stands, beetles may attack both lodgepole and ponderosa pine. At several low elevation sites I the project area mountain pine beetle has killed noticeable amounts of ponderosa pine.

WESTERN BALSAM BARK BEETLE

This beetle is a native wood-boring insect that attacks subalpine fir, and rarely Engelmann spruce (Garbutt, 1992, as cited in Natural Resources of Canada, 2003). In American and Crooked River they have been identified in the upper elevation spruce-fir stands, but numbers of affected trees are currently relatively low. Their successional function is to kill old subalpine fir, favoring establishment of new subalpine fir. This may not change Cover Types, but can contribute to development of more uneven-age structure, and fuel accumulations. It is estimated that this beetle is at endemic levels and will remain so unless environmental factors change significantly.

BALSAM WOOLLY ADELGID

This is a sucking insect introduced from Europe that is now found in the American and Crooked River watershed in a few areas, but the extent to which it may increase in population and activity is not known. Stem attacks can lead to eventual tree mortality. Crown attack can ultimately affect bud formation and upward growth and can also lead to tree mortality. This insect more often attacks young trees so its successional effect is to reduce stand density and reduce vertical canopy layering by affecting understory fir. Cold winters control populations, while warm summers favor their survival.

DOUGLAS FIR BEETLE

This is a native bark beetle that is not typically very aggressive and usually attacks wind thrown, fire-damaged trees or trees weakened by other pathogens or drought (Hagle et al., 1987, Schmitz and Gibson, 1996). Where Douglas fir occurs with early seral larch or pine, beetle activity will help maintain the early seral species. On grand fir and subalpine fir habitat types, like those that dominate American and Crooked River, Douglas fir beetle activity creates openings where more shade-tolerant species like grand fir will grow and push the stand more quickly toward late seral conditions and uneven aged stand structure (Hagle et al., 2000). Observed pockets of Douglas fir beetle in the watershed have been small and occur in areas where past fires were not stand replacing so that large old Douglas fir remain. Many of these pockets are associated with old growth and will provide large Douglas fir snags.

Because of extensive fire in the late 1800s and subsequent harvest, large Douglas firs in dense stands are not abundant in the watershed so the potential for extensive beetle outbreaks is relatively low.

ROOT DISEASES

Root diseases are fungi that can affect all sizes, ages and species of tree (Hagle et al., 1987, Hagle et al., 2000). In the watershed, grand fir and Douglas-fir are most highly susceptible and the

prevailing root pathogens affecting them are armillaria and annosus root rots. With the loss of lodgepole pine to mountain pine beetle, grand fir and subalpine fir will increase, and root disease will likely also increase. However this change is not toward conditions that are outside historic ranges. Where Douglas-fir has encroached on ponderosa pine stands, these will be more susceptible to root disease.

Fire and root disease appear to have contributed historically to the maintenance of larch in mixed conifer stands. Without fire, root disease is unlikely to sufficiently limit grand fir to keep larch from being eventually eliminated.

Root disease has probably increased a small amount in average severity. The older stands become and the more they shift toward grand fir, the more severe root disease will be. Root disease may recover a more important role if lodgepole dominance is reduced and Douglas-fir and grand fir increase. It will affect canopy cover, Cover Types, size, and age distribution of trees, and timber productivity. The effects will be to create forest openings, favoring shrubs and regeneration of more susceptible grand fir or increased dominance by less susceptible species. Over the long term, without fire or harvest to sustain less susceptible species, more tree species will become susceptible.

BLISTER RUST

Virtually no western white pine or whitebark pine has been inventoried in the drainage so the potential for blister rust is low. The historic potential for these tree species appears to have been very low also.

DWARF MISTLETOE

Dwarf mistletoes are parasitic plants that extract water and nutrients from living conifer trees (Hagle et al. 2000). Lodgepole pine. Lodgepole pine dwarf mistletoe is the species most active in the American and Crooked River watershed, because of the importance of this cover type. Initial effects are to reduce stand density and size dominance within the affected species and size class. Successional effects where mistletoe is severe are to accelerate succession toward grand fir or subalpine fir. Fires that kill host species also reduce mistletoe.

Overall, dwarf mistletoes affect a relatively small proportion of the American and Crooked River project area. Compared to mountain pine beetle, the effects of dwarf mistletoe in lodgepole pine are likely to be minor. The thinning effect of mountain pine beetle will reduce dwarf mistletoe on lodgepole pine in the American and Crooked River area.

3.10.2.3. INDICATOR 3 – RARE PLANTS (SEE SECTION 3.10.1.3)

FULL SUMMARY OF CUMULATIVE EFFECTS FOR VEGETATION

VRU 1

- Grand fir and subalpine fir have increased.
- Acres of early seral herbaceous shrub, sapling and small tree stands have increased.
- Medium and large trees have decreased.
- Acreage of non-forest openings have declined.

VRU 3

- Ponderosa pine and western larch have declined.
- Grand fir and Douglas-fir have increased.

- Lodgepole pine stands have shifted towards mixed conifer.
- Small trees have increased.
- Medium and large trees have declined.
- Vertical canopy layers have increased, while canopy density has declined.

VRU 6

- Lodgepole pine dominance has decreased.
- Mixed conifer stands of small trees have increased.
- Large trees have decreased.
- Tree canopy density has declined.
- Age class and patch size diversity have declined.
- Old growth is estimated at 4.9 percent of the potential forested acres of this VRU in the American and Crooked River watershed. This is within the historic range of 5 to 15 percent that would normally be expected occupy this VRU.

VRU 7

- Acres of small trees have increased.
- Tree canopy density has decreased.
- Extensive snag patches have decreased, except for patches associated with lodgepole pine mortality.
- Old growth is estimated at 18.5 percent of the potential forested acres of the VRU in the American and Crooked River watershed. Historically, 15-30 percent old growth would normally be expected to occupy this VRU.

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